

Specification for Welding Procedure and Performance Qualification



American Welding Society®



second printing, March 2012

AWS B2.1/B2.1M:2009-ADD1
An American National Standard

Approved by the
American National Standards Institute
August 22, 2008
Addenda: February 23, 2012

Specification for

Welding Procedure and

Performance Qualification

5th Edition

Supersedes AWS B2.1:2005

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This specification provides the requirements for qualification of welding procedure specifications, welders, and welding operators for manual, semiautomatic, mechanized, and automatic welding. The welding processes included are electro-gas welding, electron beam welding, electrosag welding, flux cored arc welding, gas metal arc welding, gas tungsten arc welding, laser beam welding, oxyfuel gas welding, plasma arc welding, shielded metal arc welding, stud arc welding, and submerged arc welding. Base metals, filler metals, qualification variables, welding designs, and testing requirements are also included.



American Welding Society®
550 N.W. LeJeune Road, Miami, FL 33126

International Standard Book Number: 978-0-87171-512-8
American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126
© 2009 by American Welding Society
All rights reserved
Printed in the United States of America
Addenda: 2nd Printing, February 23, 2012

Photocopy Rights. No portion of this standard may be reproduced, stored in a retrieval system, or transmitted in any form, including mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright owner.

Authorization to photocopy items for internal, personal, or educational classroom use only or the internal, personal, or educational classroom use only of specific clients is granted by the American Welding Society provided that the appropriate fee is paid to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, tel: (978) 750-8400; Internet: <www.copyright.com>.

Statement on the Use of American Welding Society Standards

All standards (codes, specifications, recommended practices, methods, classifications, and guides) of the American Welding Society (AWS) are voluntary consensus standards that have been developed in accordance with the rules of the American National Standards Institute (ANSI). When AWS American National Standards are either incorporated in, or made part of, documents that are included in federal or state laws and regulations, or the regulations of other governmental bodies, their provisions carry the full legal authority of the statute. In such cases, any changes in those AWS standards must be approved by the governmental body having statutory jurisdiction before they can become a part of those laws and regulations. In all cases, these standards carry the full legal authority of the contract or other document that invokes the AWS standards. Where this contractual relationship exists, changes in or deviations from requirements of an AWS standard must be by agreement between the contracting parties.

AWS American National Standards are developed through a consensus standards development process that brings together volunteers representing varied viewpoints and interests to achieve consensus. While the AWS administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in its standards.

AWS disclaims liability for any injury to persons or to property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this standard. AWS also makes no guarantee or warranty as to the accuracy or completeness of any information published herein.

In issuing and making this standard available, AWS is neither undertaking to render professional or other services for or on behalf of any person or entity, nor is AWS undertaking to perform any duty owed by any person or entity to someone else. Anyone using these documents should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. It is assumed that the use of this standard and its provisions is entrusted to appropriately qualified and competent personnel.

This standard may be superseded by the issuance of new editions. Users should ensure that they have the latest edition.

Publication of this standard does not authorize infringement of any patent or trade name. Users of this standard accept any and all liabilities for infringement of any patent or trade name items. AWS disclaims liability for the infringement of any patent or product trade name resulting from the use of this standard.

Finally, the AWS does not monitor, police, or enforce compliance with this standard, nor does it have the power to do so.

On occasion, text, tables, or figures are printed incorrectly, constituting errata. Such errata, when discovered, are posted on the AWS web page (www.aws.org).

Official interpretations of any of the technical requirements of this standard may only be obtained by sending a request, in writing, to the appropriate technical committee. Such requests should be addressed to the American Welding Society, Attention: Managing Director, Technical Services Division, 550 N.W. LeJeune Road, Miami, FL 33126 (see Annex H). With regard to technical inquiries made concerning AWS standards, oral opinions on AWS standards may be rendered. These opinions are offered solely as a convenience to users of this standard, and they do not constitute professional advice. Such opinions represent only the personal opinions of the particular individuals giving them. These individuals do not speak on behalf of AWS, nor do these oral opinions constitute official or unofficial opinions or interpretations of AWS. In addition, oral opinions are informal and should not be used as a substitute for an official interpretation.

This standard is subject to revision at any time by the AWS B2 Committee on Procedure and Performance Qualification. It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are required and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS B2 Committee on Procedure and Performance Qualification and the author of the comments will be informed of the Committee's response to the comments. Guests are invited to attend all meetings of the AWS B2 Committee on Procedure and Performance Qualification to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Technical Activities Committee. A copy of these Rules can be obtained from the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

This page is intentionally blank.

Personnel (Addenda)

AWS B2 Committee on Procedure and Performance Qualification

J. J. Fluckiger, Chair	<i>Idaho National Laboratory</i>
J. L. Cooley, 1st Vice Chair	<i>J. C. & Associates, Incorporated</i>
E. W. Beckman, 2nd Vice Chair	<i>Consultant</i>
A. L. Diaz, Secretary	<i>American Welding Society</i>
D. M. Allbritten	<i>GE Capital</i>
H. R. Castner	<i>Edison Welding Institute</i>
L. P. Connor	<i>Consultant</i>
D. W. Craig	<i>Computer Engineering, Incorporated</i>
W. D. Doty	<i>Doty & Associates, Incorporated</i>
E. H. Gray	<i>U.S. Nuclear Regulatory Commission</i>
B. J. Hable	<i>Ford Motor Company</i>
M. F. Herrle	<i>Arise, Incorporated</i>
K. G. Kofford	<i>Idaho National Laboratory</i>
R. A. LaFave	<i>Consultant</i>
K. Y. Lee	<i>U.S. Department of Transportation</i>
G. S. Michels	<i>Summit Consulting</i>
A. S. Olivares	<i>HSB Global Standards</i>
J. F. Pike	<i>NASA Langley Research Center</i>
W. M. Ruof	<i>Bechtel Plant Machinery, Incorporated</i>
J. J. Sekely	<i>Welding Services, Incorporated</i>
M. R. Stone	<i>Canadian Welding Bureau</i>
M. L. Thomas	<i>Rocky Mountain Testing, LLC</i>
G. M. Wisbrock, Jr.	<i>Consultant</i>
R. K. Wiswesser	<i>Welder Training & Testing Institute</i>

Advisors to the AWS B2 Committee on Procedure and Performance Qualification

W. L. Ballis	<i>Consultant</i>
J. D. Duncan	<i>Consultant</i>
N. K. Kanaya	<i>BEAR Testing Laboratory</i>
B. B. MacDonald	<i>Consultant</i>
A. W. Sindel	<i>Alstom Power Steam</i>
C. E. Spaeder	<i>Consultant</i>
W. J. Sperko	<i>Sperko Engineering Service</i>
R. F. Waite	<i>Consultant</i>

AWS B2B Subcommittee on Welding Qualifications

M. R. Stone, Chair	<i>Canadian Welding Bureau</i>
A. L. Diaz, Secretary	<i>American Welding Society</i>
D. M. Allbritten	<i>GE Capital</i>
E. W. Beckman	<i>Consultant</i>
K. L. Bingham	<i>Los Alamos National Laboratory</i>
L. P. Connor	<i>Consultant</i>
J. L. Cooley	<i>J. C. & Associates, Incorporated</i>
D. W. Craig	<i>Computer Engineering, Incorporated</i>

AWS B2B Subcommittee on Welding Qualifications (Continued)

W. D. Doty	<i>Doty & Associates, Incorporated</i>
J. J. Fluckiger	<i>Idaho National Laboratory</i>
E. H. Gray	<i>U.S. Nuclear Regulatory Commission</i>
B. J. Hable	<i>Ford Motor Company</i>
K. G. Kofford	<i>Idaho National Laboratory</i>
K. Y. Lee	<i>U.S. Department of Transportation</i>
G. S. Michels	<i>Summit Consulting</i>
A. S. Olivares	<i>HSB Global Standards</i>
J. F. Pike	<i>NASA Langley Research Center</i>
J. J. Sekely	<i>Welding Services, Incorporated</i>
G. E. Wisbrock, Jr.	<i>Consultant</i>
R. K. Wiswesser	<i>Welder Training & Testing Institute</i>

Advisors to the AWS B2B Subcommittee on Welding Qualifications

W. L. Ballis	<i>Consultant</i>
J. D. Duncan	<i>Consultant</i>
J. G. Feldstein	<i>Foster Wheeler North America</i>
N. K. Kanaya	<i>BEAR Testing Laboratory</i>
V. A. McCray	<i>ExxonMobil Research and Engineering Company</i>
A. W. Sindel	<i>Alstom Power Steam</i>
W. J. Sperko	<i>Sperko Engineering Service</i>

AWS B2C Subcommittee on Materials

W. M. Ruof, Chair	<i>Bechtel Plant Machinery, Incorporated</i>
A. L. Diaz, Secretary	<i>American Welding Society</i>
C. D. Agosti	<i>The Lincoln Electric Company</i>
W. D. Doty	<i>Doty & Associates, Incorporated</i>
J. J. Fluckiger	<i>Idaho National Laboratory</i>
M. F. Herrle	<i>Arise, Incorporated</i>
K. G. Kofford	<i>Idaho National Laboratory</i>
R. A. LaFave	<i>Consultant</i>

Advisors to the AWS B2C Subcommittee on Materials

C. E. Cross	<i>Federal Institute for Material</i>
A. Donlevy	<i>International Titanium Association</i>
P. Pollak	<i>Pollak & Associates</i>
A. P. Seidler	<i>Armco Steel</i>
A. W. Sindel	<i>Alstom Power Steam</i>
C. E. Spaeder	<i>Consultant</i>
L. T. Vernam	<i>AlcoTec Wire Corporation</i>
G. E. Wisbrock, Jr.	<i>Consultant</i>

Personnel (Original)

AWS B2 Committee on Procedure and Performance Qualification

J. J. Fluckiger, Chair	<i>Idaho National Laboratory</i>
J. L. Cooley, 1st Vice Chair	<i>J. C. and Associates, Incorporated</i>
E. W. Beckman, 2nd Vice Chair	<i>International Training Institute</i>
S. Morales, Secretary	<i>American Welding Society</i>
L. P. Connor	<i>Consultant</i>
W. D. Doty	<i>Doty and Associates, Incorporated</i>
E. H. Gray	<i>U.S. Nuclear Regulatory Commission</i>
B. J. Hable	<i>Ford Motor Company</i>
M. Herrle	<i>Arise, Incorporated</i>
R. A. LaFave	<i>Elliott Company, Incorporated</i>
K. Y. Lee	<i>The Lincoln Electric Company</i>
K. M. McTague	<i>Factory Mutual</i>
A. S. Olivares	<i>HSB Global Standards</i>
J. F. Pike	<i>NASA Langley Research Center</i>
W. M. Ruof	<i>Bechtel Plant Machinery, Incorporated</i>
J. J. Sekely	<i>Welding Services, Incorporated</i>
M. R. Stone	<i>Canadian Welding Bureau</i>
G. M. Wisbrock, Jr.	<i>Lockheed Martin Missiles and Fire Control (Retired)</i>
R. K. Wiswesser	<i>Welder Training and Testing Institute</i>

Advisors to the AWS B2 Committee on Procedure and Performance Qualification

W. L. Ballis	<i>Consultant</i>
J. D. Duncan	<i>Consultant</i>
N. K. Kanaya	<i>BEAR Testing Laboratory</i>
B. B. MacDonald	<i>Consultant</i>
A. W. Sindel	<i>Alstom Power—USA</i>
C. E. Speader, Jr.	<i>Aristech Chemical Corporation</i>
W. J. Sperko	<i>Sperko Engineering Services</i>
R. F. Waite	<i>Consultant</i>

AWS B2A Subcommittee on Brazing Qualification

J. L. Cooley, Chair	<i>J. C. and Associates, Incorporated</i>
S. Morales, Secretary	<i>American Welding Society</i>
J. J. Fluckiger	<i>Idaho National Laboratory</i>
L. Guimaraes	<i>National Automotive Corporation</i>
R. A. LaFave	<i>Elliott Company</i>
R. L. Peaslee	<i>Wall Colmonoy Corporation</i>
W. J. Sperko	<i>Sperko Engineering Services</i>
K. P. Thornberry	<i>Care Medical, Incorporated</i>
G. M. Wisbrock, Jr.	<i>Lockheed Martin Missiles and Fire Control (Retired)</i>
R. K. Wiswesser	<i>Welder Training and Testing Institute</i>

Advisors to the AWS B2A Subcommittee on Brazing Qualification

W. D. Rupert	<i>Wolverine Joining Technologies</i>
J. J. Sekely	<i>Welding Services, Incorporated</i>
C. E. Spaeder	<i>Consultant</i>

AWS B2B Subcommittee on Welding Qualification

G. M. Wisbrock, Jr., Chair	<i>Lockheed Martin Missiles and Fire Control (Retired)</i>
S. Morales, Secretary	<i>American Welding Society</i>
E. W. Beckman	<i>International Training Institute</i>
L. P. Connor	<i>Consultant</i>
J. L. Cooley	<i>J. C. and Associates, Incorporated</i>
W. D. Doty	<i>Doty and Associates, Incorporated</i>
J. J. Fluckiger	<i>Idaho National Laboratory</i>
E. H. Gray	<i>U.S. Nuclear Regulatory Commission</i>
B. J. Hable	<i>Ford Motor Company</i>
K. Y. Lee	<i>The Lincoln Electric Company</i>
K. M. McTague	<i>Factory Mutual</i>
A. S. Olivares	<i>HSB Global Standards</i>
J. F. Pike	<i>NASA Langley Research Center</i>
J. J. Sekely	<i>Welding Services, Incorporated</i>
M. R. Stone	<i>Canadian Welding Bureau</i>
R. K. Wiswesser	<i>Welder Training and Testing Institute</i>

Advisors to the AWS B2B Subcommittee on Welding Qualification

W. L. Ballis	<i>Consultant</i>
J. D. Duncan	<i>Consultant</i>
N. K. Kanaya	<i>BEAR Testing Laboratory</i>
V. A. McCray	<i>ExxonMobil Research and Engineering Company</i>
A. W. Sindel	<i>Sindel and Associates</i>
W. J. Sperko	<i>Sperko Engineering Services</i>

AWS B2C Subcommittee on Materials

W. M. Ruof, Chair	<i>Bechtel Plant Machinery, Incorporated</i>
S. Morales, Secretary	<i>American Welding Society</i>
W. D. Doty	<i>Doty and Associates, Incorporated</i>
J. J. Fluckiger	<i>Idaho National Laboratory</i>
M. Herrle	<i>Arise, Incorporated</i>
R. A. LaFave	<i>Elliott Company, Incorporated</i>

Advisors to the AWS B2C Subcommittee on Materials

C. E. Cross	<i>Federal Institute for Material</i>
A. Donlevy	<i>International Titanium Association</i>
G. L. Hoback	<i>Haynes International</i>
B. Moore	<i>Spectrulite</i>
P. Pollak	<i>Aluminum Association</i>
A. P. Seidler	<i>Armco Steel</i>
A. W. Sindel	<i>Sindel and Associates</i>
C. E. Speader, Jr.	<i>Aristech Chemical Corporation</i>
L. T. Vernam	<i>AlcoTec Wire Corporation</i>
G. M. Wisbrock, Jr.	<i>Lockheed Martin Missiles and Fire Control (Retired)</i>

AWS B2D Subcommittee on Standard Welding Procedure Specifications

J. J. Sekely, Chair	<i>Welding Services, Incorporated</i>
S. Morales, Secretary	<i>American Welding Society</i>
L. P. Connor	<i>Consultant</i>
W. D. Doty	<i>Doty and Associates, Incorporated</i>
J. J. Fluckiger	<i>Idaho National Laboratory</i>
K. M. McTague	<i>Factory Mutual</i>
W. M. Ruof	<i>Bechtel Plant Machinery, Incorporated</i>

Advisor to the AWS B2D Subcommittee on Standard Welding Procedure Specifications

G. M. Wisbrock, Jr.	<i>Lockheed Martin Missiles and Fire Control (Retired)</i>
---------------------	--

AWS B2E Subcommittee on Soldering Qualification

E. W. Beckman, Chair	<i>International Training Institute</i>
S. Morales, Secretary	<i>American Welding Society</i>
J. L. Cooley	<i>J. C. and Associates, Incorporated</i>
J. J. Fluckiger	<i>Idaho National Laboratory</i>
E. H. Gray	<i>U.S. Nuclear Regulatory Commission</i>
P. T. Vianco	<i>Sandia National Laboratories</i>

Advisors to the AWS B2E Subcommittee on Soldering Qualification

G. M. Wisbrock, Jr.	<i>Lockheed Martin Missiles and Fire Control</i>
R. Zahner	<i>A Zahner Company</i>

AWS B2F Subcommittee on Plastic Welding Qualification

L. T. Hutton, Chair	<i>ARKEMA, Incorporated</i>
R. Hanselka, Vice Chair	<i>Advanced Industrial Design</i>
S. P. Hedrick, Secretary	<i>American Welding Society</i>
K. Argasinki	<i>Solvay Solexis</i>
R. Basile	<i>AB Plastics, Incorporated</i>
M. Callahan	<i>Local 290</i>
D. Chandler	<i>Engiplast, Incorporated</i>
J. Craig	<i>McElroy Manufacturing, Incorporated</i>
P. Demchko	<i>Solvay Solexis</i>
J. J. Fluckiger	<i>Idaho National Laboratory</i>
S. M. Gardiner	<i>IPS Corporation</i>
D. P. Glavin	<i>Steamfitters Local Union 449</i>
G. Hopkins	<i>Plastek Werks, Incorporated</i>
J. Leary	<i>Asahi American, Incorporated</i>
B. B. MacDonald	<i>Consultant</i>
P. F. Martin	<i>United Association</i>
C. L. Parker	<i>Lubrizol Advanced Materials, Incorporated</i>
G. Sample	<i>George Fischer</i>
J. Sciadini	<i>Tech South, Incorporated</i>
K. C. Thomas	<i>Quadrant EPP</i>
M. J. Troughton	<i>TWI</i>
D. Ziegler	<i>Wegener North America, Incorporated</i>
P. Zitkus	<i>Wegener Welding</i>

Advisors to the AWS B2F Subcommittee on Plastic Welding Qualification

J. Hessel	<i>Hessel Ingenieurtechnik GmbH</i>
R. James	<i>International Training Institute</i>
A. Lopez	<i>Dow Chemical</i>
G. M. Wisbrock, Jr.	<i>Lockheed Martin Missiles and Fire Control (Retired)</i>

Foreword

This foreword is not part of AWS B2.1/B2.1M:2009-ADD1, *Specification for Welding Procedure and Performance Qualification*, but is included for informational purposes only.

The AWS B2 Committee on Procedure and Performance Qualification was formed in 1979. The first edition of B2.1, *Standard for Welding Procedure and Performance Qualification*, was published in 1984. This standard introduced the concept of Standard Welding Procedure Specifications (SWPSs) in addition to a set of rules for qualifying welding procedures, welders, and welding operators. The following edition, renamed B2.1:1998, *Specification for Welding Procedure and Performance Qualification*, was an extensive revision of B2.1-84. The Committee has published sixty-two Standard Welding Procedure Specifications; B2.2, *Standard for Brazing Procedure and Performance Qualification*; B2.3, *Specification for Soldering Procedure and Performance Qualification*; and B2.4, *Specification for Welding Procedure and Performance Qualification for Thermoplastics*.

AWS B2.1-84, *Standard for Welding Procedure and Performance Qualification*, was revised in 1998, 2000, and 2005.

This is the fifth edition of B2.1, *Specification for Welding Procedure and Performance Qualification*. This revision has undergone several modifications including incorporation of SI units; a major reformatting effort that has renumbered existing clauses, tables, figures, and annexes; the addition of new sample forms; and the deletion of any reference to “sheet metals.” New welding and qualification variables and tighter restrictions have been made within 4.13 and 4.14. Table C.1 in Annex C, Filler Metal Groupings, has been updated to reflect revised filler metal specifications. Several new materials have been added in this edition within the Base Metal Groupings. Among the new additions are materials from Australian and New Zealand standards; a few new 10H materials, such as ASTM A 182, A 240, A 276, A 479, A 789, and A 790; and other adopted ASTM materials, including ASTM A 795, A 815, A 890, A 928, and A 995. In order to facilitate the adoption of new materials, the informative annex titled *Guidelines for Requesting Adoption of New Materials under the B2.1 Standard* has been added.

Underlined text in clauses, tables, or figures indicates an editorial or technical change from the 2005 edition. A vertical line in the margin also indicates a revision from the 2005 edition.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS B2 Committee on Procedure and Performance Qualification, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

Addenda

The following Addenda have been identified and are incorporated in this reprint.

Page 73—**D1. Base Metal Specifications**—Remove “AISI”

Page 73—**D1. Base Metal Specifications**—Add “Table D.3 List base metal specifications for iron castings in accordance with AWS D11.2 groups”

Pages 74–135—**Table D.1, List of Base Metal Specifications**—New base metals have been added and corrections have been made to Table D.1

Pages 136–258—**Table D.2, M-Number Listing of Base Metals**—New base metals have been added and corrections have been made to Table D.2

Errata

The following Errata have been identified and are incorporated in this reprint.

Page 35—**5.6.1.1(11)**—*Correct* “A change in thickness or diameter from that tested except as permitted in Tables 5.6, 5.7, 5.8, and 5.9.” to “A change in thickness or diameter from that tested except as permitted in Tables 5.6, 5.7, and 5.8.”

Page 62—**Figures B.5A, Guided Bend Fixture—Bottom Ejecting Type—MILLIMETERS, Base Metal^b**—*Correct* “All base metal welded with F-23 filler metals” to “All base metals welded with F-23 consumables”

Page 62—**Figures B.5A, Guided Bend Fixture—Bottom Ejecting Type—MILLIMETERS, Base Metal^b, A**—*Correct* “(16-1/2) TS 52” to “(16-1/2) TS 50”, “(6-2/3)TS 64” to “(6-2/3)TS 67”, “4TS 38” to “4TS 40”

Page 62—**Figures B.5A, Guided Bend Fixture—Bottom Ejecting Type—MILLIMETERS, Base Metal^b, C**—*Correct* “(18-1/2)TS+1/16 60” to “(18-1/2)TS+1/16 57”, “(8-2/3)TS+3 86” to “(8-2/3)TS+3 90”, “6TS+3 60” to “6TS+3 63”

Page 63—**Figures B.5B, Guided Bend Fixture—Bottom Type—MILLIMETERS, Base Metal^b**—*Correct* “All base metal welded with F-23 filler metals” to “All base metals welded with F-23 consumables”

Page 63—**Figures B.5B, Guided Bend Fixture—Bottom Type Q—MILLIMETERS, Base Metal^b, A**—*Correct* “(16-1/2) TS 52” to “(16-1/2) TS 50”, “(6-2/3)TS 64” to “(6-2/3)TS 67”, “4TS 38” to “4TS 40”

Page 63—**Figures B.5B, Guided Bend Fixture—Bottom Type—MILLIMETERS, Base Metal^b, C**—*Correct* “(18-1/2) TS+1/16 60” to “(18-1/2)TS+1/16 57”, “(8-2/3)TS+3 86” to “(8-2/3)TS+3 90”, “6TS+3 60” to “6TS+3 63”

Page 63—**Figures B.5B, Guided Bend Fixture—Bottom Type—Note b**—*Correct* “For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing (see also Figures B.5B and B.5C).” to “For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing (see also Figures B.5A and B.5C).”

Page 64—**Figures B.5C, Guided Bend Fixture—Wrap-Around—MILLIMETERS, Base Metal^b**—*Correct* “All base metal welded with F-23 filler metals” to “All base metals welded with F-23 consumables”

Page 64—**Figures B.5C, Guided Bend Fixture—Wrap-Around—MILLIMETERS, Base Metal^b, A**—*Correct* “(16-1/2) TS 52” to “(16-1/2) TS 50”, “(6-2/3)TS 64” to “(6-2/3)TS 67”, “4TS 38” to “4TS 40”

Page 64—**Figures B.5C, Guided Bend Fixture—Wrap-Around—Note^b**—*Correct* “For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing. See also Figures B.5B and B.5C.” to “For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing (see also Figures B.5A and B.5B).”

Table of Contents

	Page No.
<i>Personnel (Addenda)</i>	v
<i>Personnel (Original)</i>	vii
<i>Foreword</i>	xi
<i>List of Tables</i>	xiv
<i>List of Figures</i>	xiv
<i>List of Forms</i>	xv
1. Scope	1
2. Normative References	2
3. Terms and Definitions	2
4. Procedure Qualification	4
4.1 General	4
4.2 Standard Welding Procedure Specifications	4
4.3 Welding Procedures Qualified by Employer	6
4.4 Evaluation of Test Weldments	7
4.5 Qualification Thickness Limitations	7
4.6 Special Test Weldment Acceptance Criteria	10
4.7 Pipe and Plate Groove Test Weldments and Acceptance Criteria	10
4.8 Fillet Test Weldments and Acceptance Criteria	11
4.9 Cladding Test Weldment and Acceptance Criteria	12
4.10 Hardfacing Test Weldment and Acceptance Criteria	13
4.11 Stud Welds and Acceptance Criteria	14
4.12 <u>Test Weldments less than 1/16 in [1.5 mm] Acceptance Criteria</u>	18
4.13 Welding Procedure Specification Data	21
4.14 Procedure Qualification Variables	23
5. Performance Qualification	29
5.1 General	29
5.2 Qualification by Standard Test	31
5.3 Qualification by Workmanship Test	31
5.4 Test Weldments	32
5.5 Examination Procedures and Acceptance Criteria	32
5.6 Performance Qualification Variables	35
<i>Annexes</i>	45
<u>Cross Reference for Renumbered Annexes from the 2005 Code to the 2009 Code</u>	46
Annex <u>A (Normative)</u> —Basis for Establishing a Standard Welding Procedure Specification (SWPS)	47
Annex <u>B (Normative)</u> —Illustrations—Weld Position, Test Specimens, and Text Fixtures	49
Annex <u>C (Normative)</u> —Filler Metal Grouping	69
Annex <u>D (Normative)</u> —Base Metal Grouping	73
Annex <u>E (Normative)</u> —Radiographic Examination Procedure	265
Annex <u>F (Informative)</u> — <u>Sample Forms</u>	269
Annex <u>G (Informative)</u> —Macroetch Procedure	277
Annex <u>H (Informative)</u> —Guidelines for the Preparation of Technical Inquiries	279
Annex <u>I (Informative)</u> —Guidelines for Requesting Adoption of New Materials Under the AWS B2.1 Standard	281
List of AWS Documents on Welding Procedure and Performance Qualification	283

List of Tables

Table	Page No.
<u>4.1</u> Test Methods Required for Procedure Qualification	8
<u>4.2</u> Thickness and Size Limitations for Fillet Welds for Procedure Qualification	8
<u>4.3</u> Thickness Limitations of Plate and Pipe for Groove Welds for Procedure Qualification	9
<u>4.4</u> Thickness Limitations for Cladding and Hardfacing for Procedure Qualification	9
<u>4.5</u> Minimum Shear Strength for Aluminum Fillet Welds	16
<u>4.6</u> Minimum Tensile Load Requirements for Aluminum Stud Welds	18
<u>4.7</u> Minimum Torque Requirements for Steel Stud Welds	19
<u>4.8</u> Minimum Torque Requirements for Aluminum Stud Welds	19
<u>5.1</u> Examination Requirements for Performance Qualification	30
<u>5.2</u> Number of Bend Tests for Performance Qualification	31
<u>5.3</u> Allowable Base Metals for Performance Qualification	34
<u>5.4</u> Allowable Filler Metals for Performance Qualification	34
<u>5.5</u> Position Limitations for Performance Tests	36
<u>5.6</u> Limitations for Performance Qualification on Groove Welds in Pipe and Tube	44
<u>5.7</u> Limitations for Performance Qualification in Plate Groove Welds	44
<u>5.8</u> Limitations for Performance Qualification in Pipe Fillet Welds	44
<u>C.1</u> Grouping of Welding Electrodes and Rods for Qualification	70
<u>C.2</u> Classification of Ferrous Weld Metal for Procedure Qualification	72
<u>D.1</u> Listing of Base Metal Specifications—Ferrous Alloys	74
<u>D.1</u> Listing of Base Metal Specifications—Nonferrous Alloys	114
<u>D.2</u> M-Number Listing of Base Metals—Ferrous Alloys	138
<u>D.2</u> M-Number Listing of Base Metals—Nonferrous Alloys	205
<u>D.3</u> Listing of Base Metal Specifications—Iron Castings	263
<u>E.1</u> Acceptable Linear Discontinuities for Radiographic Examination	266
<u>E.2</u> Acceptable Rounded Discontinuities for Radiographic Examination	266

List of Figures

Figure	Page No.
<u>4.1</u> Welding Procedure Selection Criteria	5
<u>4.2</u> Location of Groove Weld Test Specimens—Pipe	11
<u>4.3</u> Location of Test Specimens for Welded Box Tubing	12
<u>4.4</u> Location of Tension, Longitudinal Bend, and <u>Fracture</u> Toughness Specimens— <u>Plate</u>	13
<u>4.5</u> Location of Tension, <u>Fracture</u> Toughness, and Transverse Bend Specimens— <u>Plate</u>	14
<u>4.6</u> Location of Fillet Weld Shear Test and Macroetch Specimens	15
<u>4.7</u> Fillet Weld Break Test and Macroetch Specimens for Procedure Qualification	16
<u>4.8</u> Location of Cladding Test Specimens	17
<u>4.9</u> Location of Hardfacing Test Specimens	17
<u>5.1</u> Selection of Performance Qualification Method—Workmanship Test or Standard Test	30
<u>5.2</u> Typical Workmanship Test Weldments	33
<u>5.3</u> Location of 1G, 2G, 5G, and 6G Bend Specimens—Pipe Groove Weldment	37
<u>5.4</u> Location of Bend Specimens—Combined Pipe Positions 2G and 5G	38

Figure		Page No.
<u>5.5</u>	Location of Bend Specimens for Box Tube	39
<u>5.6</u>	Location of Transverse Bend Specimens—Plate Groove Weldment.....	39
<u>5.7</u>	Location of Longitudinal Bend Specimens—Plate Groove Test Weldment.....	40
<u>5.8</u>	Location of Fillet Test Specimens—Plate.....	40
<u>5.9</u>	Location of Fillet Test Specimens—Alternate Weldment—Plate	41
<u>5.10</u>	Location of Fillet Test Specimens—Pipe	41
<u>5.11</u>	Location of Fillet Test Specimens—Alternate Weld—Pipe	42
<u>5.12</u>	Location of Cladding Specimens—Plate.....	42
<u>5.13</u>	Location of Test Specimen—Hardfacing Test Weldment—Plate.....	43
<u>B.1A</u>	Welding Test Positions—Groove, Cladding, and Hardfacing Welds.....	51
<u>B.1B</u>	Limits of Welding Positions—Groove, Cladding, and Hardfacing Welds	52
<u>B.1C</u>	Welding Test Positions—Fillet Welds	53
<u>B.1D</u>	Limits of Welding Positions—Fillet Welds	54
<u>B.1E</u>	Welding Positions—Stud Welds	55
<u>B.2A</u>	Transverse Face and Root Bend Specimens	56
<u>B.2B</u>	Longitudinal Face and Root Bend Specimens	57
<u>B.2C</u>	Transverse Side Bend Specimens	57
<u>B.3A</u>	Reduced Section Tension Specimen—Rectangular.....	58
<u>B.3B</u>	Reduced Section Tension Specimen—Round	59
<u>B.3C</u>	Alternate Tension Specimen for Pipe 3 in [76 mm] O.D. or Less	59
<u>B.3D</u>	Alternate Tension Specimen for Pipe 2 in [51 mm] O.D. or Less	60
<u>B.4A</u>	Weld Cladding Side Bend Specimens.....	61
<u>B.4B</u>	Weld Cladding and Hardfacing Chemical Analysis Specimens	61
<u>B.5A</u>	Guided Bend Fixture—Bottom Ejecting Type	62
<u>B.5B</u>	Guided Bend Fixture—Bottom Type	63
<u>B.5C</u>	Guided Bend Fixture—Wrap-Around	64
<u>B.5D</u>	Stud Weld Bend Test Fixture	65
<u>B.5E</u>	Stud Weld Torque Test Fixture	66
<u>B.5F</u>	Stud Weld Tension Test Fixture	67
<u>E.1</u>	Rounded Indication Charts for Radiographic Examination.....	267

List of Forms

Form		Page No.
<u>F.1</u>	Example of a Performance Qualification Test Record.....	270
<u>F.2</u>	Example of a Welding Procedure Specification	271
<u>F.3</u>	Example of a Procedure Qualification Record	273
<u>F.4</u>	Example of a Welding Procedure Specification and a Procedure Qualification Record for Stud Welding.....	275
<u>F.5</u>	Example of a Welding Procedure Specification and a Procedure Qualification Record for Electroslag and Electrogas Welding	276

This page is intentionally blank.

Specification for Welding Procedure and Performance Qualification

1. Scope

This specification provides requirements for welding procedure and welding performance qualification. It is the intent that this specification be referenced by other documents, such as codes, specifications, contracts, and quality control or quality assurance manuals. Such documents are recognized in this specification as Referencing Documents. Requirements imposed by the Referencing Document supersede the requirements of this specification.

The requirements for the qualification of welding procedures are provided in Clause 4, Procedure Qualification. The requirements for the performance qualification of welders and welding operators are provided in Clause 5, Performance Qualification.

This specification also defines and establishes qualification variables. Qualification requirements are based on the premise that the Referencing Document will specify fabrication, design, base metal, filler metal, preheat, interpass temperature, postweld heat treatment, nondestructive examination, and test requirements applicable to the product. Welding procedure and performance qualifications which meet the requirements of other codes and specifications are acceptable, provided they also meet the requirements of this specification.

Base metals and filler metals have been grouped into categories that will minimize the number of qualification tests required. Substitution of one base metal or filler metal for another, even when within the allowable rules, should only be made after an evaluation of the material's suitability for its intended use. For some materials, additional tests may be appropriate to verify the material's suitability. Materials not listed require separate qualification.

This specification is intended for use with the following welding processes:

EBW = Electron Beam Welding
EGW = Electroslag Welding

ESW = Electroslag Welding
FCAW = Flux Cored Arc Welding
GMAW = Gas Metal Arc Welding
GTAW = Gas Tungsten Arc Welding
LBW = Laser Beam Welding
OFW = Oxyfuel Gas Welding
PAW = Plasma Arc Welding
SAW = Submerged Arc Welding
SMAW = Shielded Metal Arc Welding
SW = Stud Arc Welding

Employers shall be responsible for the welding performed by their organization, including the use of qualified welding procedures, qualified welders, and qualified welding operators. The welding procedure may be an AWS Standard Welding Procedure Specification (SWPS) published by the American Welding Society, or it shall be qualified by the Employer as required under the rules of Clause 4, Procedure Qualification. It is the Employer's responsibility to assure that Welding Procedure Specifications (WPSs) meet all requirements of the Referencing Document.

When not otherwise specified by the Referencing Document, the edition of this specification to be used should be established in accordance with the following:

- (1) Editions may be used at any time after the effective date of issue.
- (2) Latest edition of this document should be used for new contracts.
- (3) Editions established by contract date may be used during the entire term of the contract, or the provisions of later editions may be used when agreed upon by the contracting parties.

This standard makes use of both U.S. Customary Units and the International System of Units (SI). The latter are shown within brackets [] or in appropriate columns in tables and figures. The measurements may not be exact equivalents; therefore, each system must be used independently.

Safety and health issues and concerns are beyond the scope of this standard and therefore are not fully addressed herein. Safety and health information is available from other sources, including but not limited to, ANSI Z49.1, Safety in Welding, Cutting, and Allied Processes, and applicable federal, state, and local regulations. Additionally, the cautionary notes contained in the Material Safety Data Sheets (MSDSs) supplied by the material supplier should be part of each Employer's safety program. Further safety information is available in the Safety and Health Facts Sheets published by the American Welding Society.

It is the responsibility of the Employer to establish appropriate safety and health practices and to determine the applicability of any regulatory limitations prior to welding.

2. Normative References

The following standards contain provisions which, through reference in this text, constitute mandatory provisions of this AWS standard. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

AWS Documents:¹

(1) AWS A3.0, *Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*;

(2) AWS B4.0, *Standard Methods for Mechanical Testing of Welds*;

(3) AWS D1.4/D1.4M, *Structural Welding Code—Reinforcing Steel*; and

(4) AWS D11.2, *Guide for Welding Iron Casting*.

Other Documents:

(5) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*;²

(6) ASME Boiler and Pressure Vessel Code, Section V;³

¹ AWS standards are published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

² ANSI Z49.1 is published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

³ ASME standards are published by the American Society of Mechanical Engineers, 3 Park Avenue, New York, NY 10016-5990.

(7) ASME Boiler and Pressure Vessel Code, Section IX; and

(8) ASTM E 165, *Standard Test Method for Liquid Penetrant Examination*.⁴

3. Terms and Definitions

AWS A3.0, *Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*, provides the basis for terms and definitions used herein. However, the following terms and definitions are included below to accommodate usage specific to this document.

A-Number. A designation used to classify ferrous weld metal for procedure qualification based upon chemical composition (see Annex C).

Employer. The contractor or manufacturer that adopts this specification for welding procedure and performance qualification. Closely related companies, including those with different names, for which effective control of welding is as one organization, shall be considered as one Employer.

F-Number. A designation used to group welding filler metal for procedure and performance qualifications (see Annex C).

fracture toughness. A mechanical property of materials exhibiting its ability to contain a crack and resist fracture as determined by any of the following tests: Charpy V-notch, dynamic tear, plane-strain fracture toughness, and drop-weight nil-ductility transition temperature.

interpass temperature. In a multipass weld, the minimum (preheat) or maximum metal temperature immediately prior to applying the second or all subsequent passes.

M-Number. A designation used to group base metals for procedure and performance qualifications consistent with the P-Number and S-Number designations established by the ASME Boiler and Pressure Vessel Code, Section IX, but which also incorporate materials not recognized or used under ASME rules (see Annex D).

pipe. Used generally to refer to pipe and tube.

plate. Used to refer to rolled, extruded, or forged products other than pipe and tube.

⁴ ASTM International standards are published by the American Society of Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

preheat temperature. The temperature of the base metal in the welding area immediately before any welding is performed.

Procedure Qualification Record (PQR). A written record of welding variables used to produce an acceptable test weldment and the results of tests conducted on that weldment to qualify a welding procedure specification.

procedure qualification variable. One of a set of elements that define the qualification limits of a Welding Procedure Specification (WPS).

performance qualification variable. One of a set of requirements that define the qualification limits of welders and welding operators.

qualification variable. See **performance qualification variable** and **procedure qualification variable**.

qualified welding procedure. A Welding Procedure Specification (WPS) meeting the qualification requirements of this specification based on qualification tests of weldments. Qualified welding procedures are of two types:

(1) AWS Standard Welding Procedure Specifications (SWPSs) published by the American Welding Society, and

(2) Welding Procedure Specifications (WPSs) qualified by an Employer for the Employer's own use.

Qualifier. The Employer, organization, or individual responsible for conducting and supervising qualification testing.

Referencing Document. The fabrication code, specification, contract document, or internal document such as quality control or quality assurance manuals that invokes this specification.

root shielding gas. A shielding gas used to provide a protective atmosphere to the root surface of the weld.

specimen. The article made from a specimen blank that is evaluated for qualification purposes. In some cases, the test weldment is also the specimen.

specimen blank. That portion of a test weldment removed for the production of a specimen. In some cases, the specimen blank is also the specimen.

Standard Welding Procedure Specification (SWPS). AWS Standard Welding Procedure Specifications published by the American Welding Society.

T. A symbol for base metal thickness, or for identifying a procedure qualification variable for fracture toughness applications, as appropriate.

TS. A symbol for test specimen thickness.

t. A symbol for weld metal thickness, which is equal to groove weld size, or to fillet weld leg size, as appropriate.

test weldment. Workpieces joined by welding to qualify welding procedures, welders, or welding operators.

torch shielding gas. Protective gas emanating from the torch, used to prevent or reduce atmospheric contamination.

welder. An individual who performs manual or semi-automatic welding.

welding operator. An individual who performs mechanized or automatic welding.

Welding Procedure Specification (WPS). A document which delineates or references all welding variables required by this specification to provide direction for welding.

welding variable. Any controllable detail of a welding procedure which is required to be addressed on the Welding Procedure Specification (WPS).

4. Procedure Qualification

4.1 General

The purpose of a welding procedure qualification is to demonstrate the capabilities of a weld to meet required properties.

4.1.1 Each welding procedure shall be qualified.

4.1.2 This standard establishes two categories of qualified welding procedures:

(1) *Category 1.* Standard Welding Procedure Specifications (SWPSs) in accordance with 4.2 supported by PQRs reviewed and validated at the Welding Research Council. The basis for establishment of an SWPS is described in Annex A.

(2) *Category 2.* Welding Procedure Specifications (WPSs) qualified by the Employer in accordance with 4.3.

To determine if SWPSs or WPSs qualified by the Employer are appropriate, the flow chart in Figure 4.1 may be utilized.

4.1.3 Tests previously conducted by an Employer to meet other codes, specifications, or earlier editions of this specification, may be used by the Employer to support a WPS in accordance with this specification. The Procedure Qualification Record(s) (PQR) must address all qualification variables (see 4.14, Procedure Qualification Variables) applicable to the welding process(es) used and the test results must meet all requirements of this specification. If all the requirements are not met, another qualification test may be conducted following the qualification variables of the original PQR. A PQR supplement shall be prepared to document the additional tests results.

4.1.4 A matrix indicating data to be included in the WPS for a process or combination of processes is provided in 4.13, Welding Procedure Specification Data. There are no required formats for WPSs or PQRs; however suggested forms are shown in Annex F. Any format may be used providing all applicable information is recorded, including a certifying statement acknowledging the validity of the data and certifying that the weld-

ments were made and tested in accordance with the requirements of AWS B2.1/B2.1M, *Specification for Welding Procedure and Performance Qualification*.

4.1.5 PQRs shall not be revised except to correct errors or add new or omitted information. All such changes shall be identified, authorized by the Employer, and dated on the PQR.

4.1.6 A WPS may require the support of more than one PQR, while one PQR may support a number of WPSs. Compatible PQRs using different qualification variables may be combined to support one WPS. Compatibility shall be determined based on either experience, or testing, or both.

4.1.7 WPSs and PQRs shall be identified according to a system that allows permanent traceability from the WPS to its supporting PQRs.

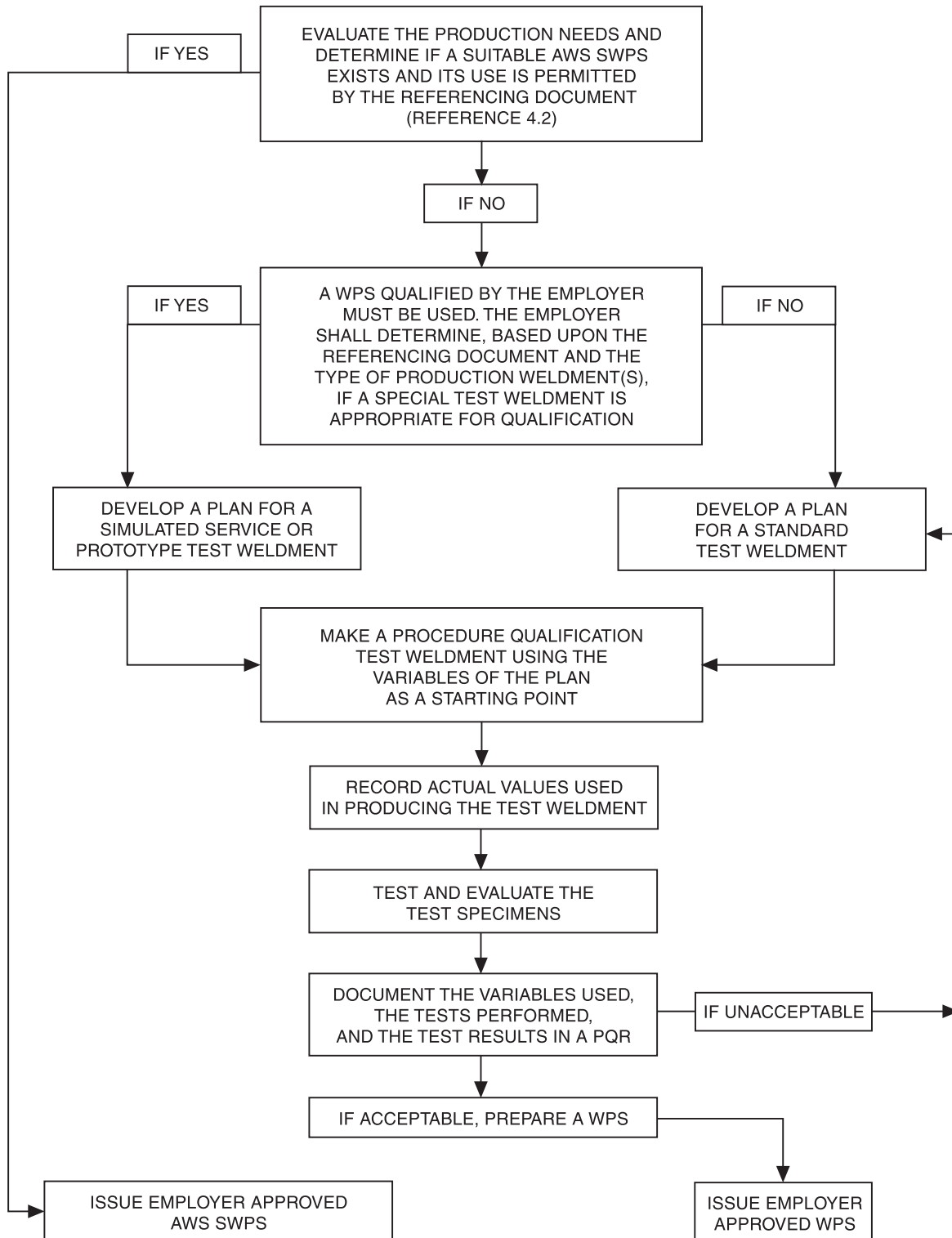
4.1.8 A change in a WPS beyond that allowed in 4.14, Procedure Qualification Variables shall require requalification of the procedure and preparation of a new or revised WPS. Changes not addressed in 4.14 shall not require requalification, provided such changes are documented in a new or revised WPS.

4.1.9 WPSs qualified to earlier editions of B2.1 shall be qualified to this edition without revision or further testing.

4.2 Standard Welding Procedure Specifications

4.2.1 Procedures permitted for use without employer qualification tests shall be limited to AWS Standard Welding Procedure Specifications (SWPSs).

4.2.2 Employers may use an SWPS without modification, if it provides sufficient direction for use in production. An Employer may supplement the SWPS with additional information or requirements, provided the welding variables remain within the ranges shown on the SWPS.



Note: Figure 4.1 is provided to aid the user of this standard in determining whether an AWS Standard Welding Procedure Specification (SWPS) may be used for their application, and if not, whether a special test weldment or a standard test weldment is applicable and the steps which must be taken to develop a welding procedure which meets the requirements of this document once these determinations have been made.

Figure 4.1—Welding Procedure Selection Criteria

4.2.3 Prior to use of an SWPS, the Employer shall signify acceptance of responsibility for the production application of the procedure by signing and dating the SWPS. SWPSs published under previous editions of this standard are acceptable for use under this edition of AWS B2.1/B2.1M, Specification for Welding Procedure and Performance Qualification.

4.2.4 Welding variables shall not be changed beyond the ranges specified in the SWPS.

4.2.5 Multiple SWPSs may not be combined to perform a single production weld.

4.2.6 SWPSs shall not be combined with or used to supplement Employer qualified WPSs.

4.2.7 An Employer's Procedure Qualification Record (PQR) shall not be used to modify an SWPS.

4.3 Welding Procedures Qualified by Employer

4.3.1 The qualification variables for the various processes used in making a procedure qualification test weld are listed in 4.14, Procedure Qualification Variables.

4.3.2 Mechanical test specimens shown in Annex B shall be used for testing. The provisions of AWS B4.0, *Standard Methods for Mechanical Testing of Welds*, may be used for mechanical testing of welds made for procedure qualification. However, in instances where the provisions of AWS B4.0 and AWS B2.1/B2.1M are in conflict, the provisions of AWS B2.1/B2.1M shall take precedence. The test results shall be recorded on or appended to a PQR containing the actual qualification variables.

4.3.3 If the results meet the acceptance criteria specified, the Employer shall sign and date the PQR indicating that the PQR is an accurate record of the welding and testing of the procedure qualification test weldment. The Employer may then prepare and issue an approved WPS. The Employer shall sign and date the WPS to signify acceptance of responsibility for use of the WPS in production.

4.3.4 Each WPS shall be supported by one or more PQRs, and shall specify a range or a single value for each welding variable applicable to the welding process identified in 4.13, Welding Procedure Specification Data. Additionally, a WPS shall specify a range or a single value for each qualification variable for the weld process used as identified in 4.14, Procedure Qualification Variables.

4.3.5 Except as permitted in Clause 1, Scope, a WPS qualified by one Employer is not transferable to another Employer.

4.3.6 Special test weldments may be used for procedure qualification, when permitted by the Referencing Document, and shall be governed by the limits on qualification variables given in 4.14, Procedure Qualification Variables.

4.3.7 This specification recognizes two types of special test weldments:

(1) *Simulated Service Test Weldments.* These are test weldments in which qualification requires tests simulating service conditions. Tests may include fracture toughness, flexural, and/or static, or cyclic loading to simulate the type of loading that the weldment will encounter in service. Proof tests such as hydrostatic or leak tests may also be appropriate.

(2) *Prototype Structure Test Weldments.* These are test weldments in which a prototype of the actual weldment is subjected to field tests in which it is loaded and demonstrated to perform the function for which it was designed.

4.3.8 Unless otherwise permitted by the Referencing Document, coated metals, such as galvanized or painted metals, require separate qualification unless the coating is removed from the weld area prior to welding.

4.3.9 Base metals are grouped for qualification purposes on the basis of weldability, similar mechanical properties, chemical composition, and metallurgical compatibility. Such groups are assigned M-Numbers in Annex D of this specification.

4.3.10 For the welding of base metals with different M-Numbers, a procedure qualification test shall be made for each combination of M-Numbers to be joined. However, a procedure qualification test with one M-Number shall also qualify for that metal welded to itself and to each of the lower M-Number metals for:

(1) Base metals M-1, M-3, M-4, and M-5A; and

(2) Welding processes SMAW, GTAW, GMAW, FCAW, SAW, and PAW melt-in-technique.

(*Example:* M-5A to M-5A would qualify for M-5A to M-5A as well as M-5A to M-4, M-5A to M-3, and M-5A to M-1.)

4.3.11 If the Referencing Document requires fracture toughness testing, then procedure qualification shall be made for each combination M-Number and Group Number to be joined. A procedure qualification shall be made for each M-Number and Group Number combination of base metals, even though procedure qualification tests have been made for each of the two base metals welded to itself.

4.3.11.1 If the Welding Procedure Specification (WPS) for welding the combination of base metals specifies the same qualification variables, including electrode or filler metal, as both WPSs for welding each base metal to itself, such as that the base metal is the only change, then the WPS for welding the combination of base metals is also qualified.

4.3.11.2 When base metals of two different M-Numbers and Group Numbers are qualified using a single test weldment, that test weldment qualifies the welding of those two M-Numbers and Group Numbers to themselves as well as to each other using the variables qualified.

4.3.12 Base metals listed in Annex D or listed in ASME *Boiler and Pressure Vessel Code*, Section IX, shall be considered as listed materials. PQRs for unlisted base metals shall not be used to support a WPS for welding listed base metals, other unlisted base metals, or vice versa. Qualification requirements for cast iron materials are given in AWS D11.2, *Guide for Welding Iron Castings*. Qualification requirements for reinforcing bar are given in AWS D1.4/D1.4M, *Structural Welding Code—Reinforcing Steel*.

4.3.13 When fracture toughness is a requirement and a qualified procedure exists which satisfies all requirements except fracture toughness, it is necessary only to prepare an additional test weldment with sufficient material to provide the required fracture toughness specimens. The test plate shall be welded using that procedure, plus those variables applicable to fracture toughness. A new or revised PQR shall be prepared and the WPS shall then be revised or a new WPS issued to accommodate the qualification variables for fracture toughness applications listed in 4.14, Procedure Qualification Variables.

4.3.14 Cladding and hardfacing require separate qualification for each base metal M-Number, and filler metal combination. Welds made to join clad metals to other clad metals or to unclad metals shall be separately qualified or may be qualified by a combination of a PQR for joining an unclad metal and a PQR for applying the cladding.

4.3.15 For stud welding, the nominal chemical composition of the stud material shall be used to classify the stud as an M-Number material for purposes of procedure qualification.

4.3.16 During the welding of procedure qualification weldments, welders and welding operators shall be under the full control and supervision of the Employer. Only activities (1), (5), (6), and (7) listed below may be subcontracted by the Employer.

- (1) Preparation of test materials for welding,

- (2) Instruction of the welder or welding operator on use of the welding procedure,

- (3) Performance of welding,

- (4) Recording of actual qualification variables used in the test (see 4.1.4),

- (5) Preparation of test specimens from the completed weldment,

- (6) Performance of examinations and tests,

- (7) Documenting of test results, and

- (8) Certification of the final PQR.

4.4 Evaluation of Test Weldments

Test weldments shall be subjected to the applicable tests in Table 4.1. The type, number, location, and evaluation criteria for tests shall be as given in 4.6 through 4.12, except that for special test weldments the evaluation of the weldment shall be in accordance with the Referencing Document.

4.5 Qualification Thickness Limitations

4.5.1 Limitations on the thickness ranges qualified by procedure qualification tests are given in the following tables:

- (1) Table 4.2—Thickness and Size Limitations for Fillet Welds for Procedure Qualification

- (2) Table 4.3—Thickness Limitations of Plate and Pipe for Groove Welds for Procedure Qualification

- (3) Table 4.4—Thickness Limitations for Cladding and Hardfacing for Procedure Qualification

4.5.2 The limitations in the tables cited in 4.5.1 are based upon the following criteria:

- (1) The size and number of passes of a fillet weld,

- (2) The base metal and weld metal thicknesses for groove welds, or

- (3) The base metal thickness for weld cladding and hardfacing.

4.5.3 Complete penetration groove welds shall also qualify partial penetration groove welds and fillet welds within the qualification limits given in Table 4.3.

Table 4.1
Test Methods Required for Procedure Qualification

	Fillet Welds			Stud Welds	Weld Cladding	Hard-Facing
	Groove Weld	Bend-Break Test	Alternate Shear Test			
Visual Examination	Yes	Yes	Yes	(Note b)	(Note b)	(Note b)
Guided Bend Tests	Yes ^a	—	—	—	Yes	—
Tension Tests	Yes	—	—	Yes, or Torque	—	—
Macro-Examination	(Note a)	Yes	Yes	Yes ^c	—	(Note b)
Bend-Break	—	Yes	—	—	—	—
Bend Tests	Yes ^a	—	—	Yes	—	—
Torque Tests	—	—	—	Yes, or Tension	—	—
Fracture Toughness Tests	(Note b)	—	—	—	—	—
Shear Tests	—	—	Yes	—	—	—
Penetrant Examination	—	—	—	—	Yes	(Note b)
Chemical Analysis	—	—	—	—	Yes	(Note b)
Hardness Test	—	—	—	—	—	Yes

^a The use of a macro examination in lieu of bend tests shall be permitted only for welds made in M-26, M-81, and M-83 base materials.

^b If specified in referencing document.

^c Except that unclad, unpainted M-1 materials are exempted.

Table 4.2
Thickness and Size Limitations for Fillet Welds for Procedure Qualification

Fillet Test Weldment	Thickness and Size Range Qualified	
	Base Metal Thickness ^{a, b, c, e}	Fillet Size (Leg) ^d
Single Pass	Unlimited	Maximum welded single-pass fillet size and smaller
Multiple Pass	Unlimited	1/2 of that welded during qualification to unlimited

^a For OFW, the maximum base metal thickness qualified is the thickness of the test weldment.

^b For GMAW-S, the maximum base metal thickness qualified is 1.1 times the test weldment thickness.

^c For fracture toughness applications less than 5/8 in [16 mm] thick, the base metal thickness of the test weldment is the minimum base metal thickness qualified.

^d For M-11 steels, the fillet size qualified shall be equal to or less than the fillet size used in the test.

^e If a test weldment receives a postweld heat treatment exceeding the lower transformation temperature, the maximum base metal thickness qualified is 1.1 times the base metal thickness of the test weldment.

Table 4.3
Thickness Limitation of Plate and Pipe for Groove Welds for Procedure Qualification

Test Weldment Thickness (T), in [mm] ^{a, b, c, d, f, g, h}	Base Metal Thickness Qualified ^{d, e}		Deposit Weld Metals Thickness Qualified (t) ^d
	Minimum, in [mm]	Maximum, in [mm]	Maximum, in [mm]
Less than 1/16 [1.5]	1/2T	2T	2t
1/16 to 3/8 [1.5 to 10]	1/16 [1.5]	2T	2t
Over 3/8 [10], but less than 3/4 [19]	3/16 [5]	2T	2t
3/4 [19] to less than 1-1/2 [38]	3/16 [5]	2T	2t when t < 3/4 [19] 2T when t ≥ 3/4 [19]
1-1/2 [38] to less than 6 [152]	3/16 [5]	8 [203]	2t when t < 3/4 [19] 8 [203] when t ≥ 3/4 [19]
6 [152] and over	1 [25]	1.33T	2t when t < 3/4 [19] 8 [203] when 3/4 [19] ≤ t < 6 [152] 1.33t when t ≥ 6 [152]

^a Provided that the weld penetration can be measured, EBW and LBW qualified thickness range shall be 1.2T for test weldments 1 in [25 mm] and under in thickness and 1.1T for weldments over 1 in [25 mm] thick. If weld penetration cannot be measured, the qualified thickness ranges are 1.1T and 1.05T respectively.

^b When the groove is filled using a combination of welding processes:

- (1) The test weldment thickness "T" is applicable for the base metal and shall be determined from the Base Metal Thickness Qualified column.
- (2) The thickness "t" of the weld metal for each welding process shall be determined from the Deposited Weld Metal thickness column.
- (3) Each welding process qualified in this combination manner may be used separately only within the same qualification variables and the thickness limits.

^c For OFW, the maximum base metal thickness qualified is the thickness of the test weldment and the maximum weld metal thickness qualified is the thickness of the weld metal deposited in the test weldment.

^d For GMAW-S, the maximum thickness of base metal qualified is 1.1 times the thickness of the test weldment until the test weldment thickness is 1/2 in [13 mm], beyond which Table 4.3 applies. The maximum weld metal thickness qualified is 1.1 times the GMAW-S weld metal thickness deposited in the weldment. In addition, for thickness 3/8 in [10 mm] thick and greater, side bend tests shall be used to qualify GMAW-S short circuit WPSs.

^e For fracture toughness applications less than 5/8 in [16 mm] thick, the base metal thickness of the test weldment is the minimum base metal thickness qualified.

^f If any single pass in the test weldment is greater in thickness than 1/2 in [13 mm], the qualified base metal thickness is 1.1 times the test weldment thickness.

^g If a test weldment receives a postweld heat treatment exceeding the lower transformation temperature, the maximum base metal thickness qualified is 1.1 times the base metal thickness of the test weldment, and the maximum weld thickness qualified is 1.1 times the weld metal of the test weldment.

^h For base metals equal to or less than 3/8 in [10 mm], fillet welds have the same base metal thickness qualifications as groove welds. For base metals thickness greater than 3/8 in [10 mm], fillet welds have unlimited base metal thickness qualified.

Notes:

T = The thickness of the Test Weldment Base Metal.

t = The thickness of the Weld Deposit, excluding reinforcement.

Table 4.4
Thickness Limitations for Cladding and Hardfacing for Procedure Qualification

Test Weldment Thickness (T), in [mm]	Qualified Base Metal Thickness, in [mm]	
	Minimum	Maximum
Less than 1 [25]	T	Unlimited
1 [25] and over	1 [25]	Unlimited

Note: The minimum weld metal thickness qualified for cladding and hardfacing is one layer if the test weldment has only one layer, and is two layers if the test weldment has two or more layers. The number of layers applies individually to each filler metal classification.

4.5.4 In addition to the welding data required to be included in the WPS by 4.13, Welding Procedure Specification Data, when multiple process or multiple filler metal classifications are used in a single test weldment, the thickness ranges permitted for use in the WPS shall apply separately to each welding process and filler metal classification. The weld deposit thickness for each welding process and each filler metal classification used in the qualification test shall be recorded on the PQR.

4.5.5 In addition to the procedure qualification variables required to be recorded on the PQR by 4.14, Procedure Qualification Variables, the weld deposit thickness for each welding process and each filler metal classification used in the qualification test shall be recorded on the PQR for all applications.

4.6 Special Test Weldment Acceptance Criteria

4.6.1 Special test weldments shall be examined and tested as specified by the Referencing Document. When a test in Table 4.1 is specified by the Referencing Document, the acceptance criteria shall be as required in this specification. The criteria for other tests shall be as specified in the Referencing Document.

4.7 Pipe and Plate Groove Test Weldments and Acceptance Criteria

4.7.1 Groove test weldments shall be large enough to provide the necessary test specimens. Multiple test weldments may be necessary to provide all the required specimens. The test weldments are illustrated in Figures 4.2, 4.3, 4.4, and 4.5. The thickness of a test weldment (T) shall be determined as provided in Tables 4.2 through 4.4.

4.7.2 Test weldments for EBW and LBW shall have a joint geometry duplicating that to be used in production.

4.7.3 Prior to removing specimen blanks from the completed test weldment, the weld shall be visually examined on all accessible surfaces and shall meet the following criteria:

(1) There shall be no evidence of cracks, incomplete fusion, or incomplete joint penetration.

(2) The depth of undercut shall not exceed the lesser of 10% of the base metal thickness or 1/32 in [1 mm].

(3) Porosity shall not exceed the limitations of the Referencing Document.

4.7.4 After visual examination, the test weldment shall be evaluated using the tests required in Table 4.1. Specimen blanks shall be removed from the locations shown in Figures 4.2 and 4.3 for pipe and box tube, respectively, and Figure 4.4 or 4.5 for plate. The preparation and dimensions of specimen blanks shall be as provided in Annex B of this specification.

4.7.5 Each tensile test specimen shall have a tensile strength not less than the following:

(1) The specified minimum tensile strength of the base metal, or of the weaker of the two base metals if metals of different minimum tensile strength are used; or

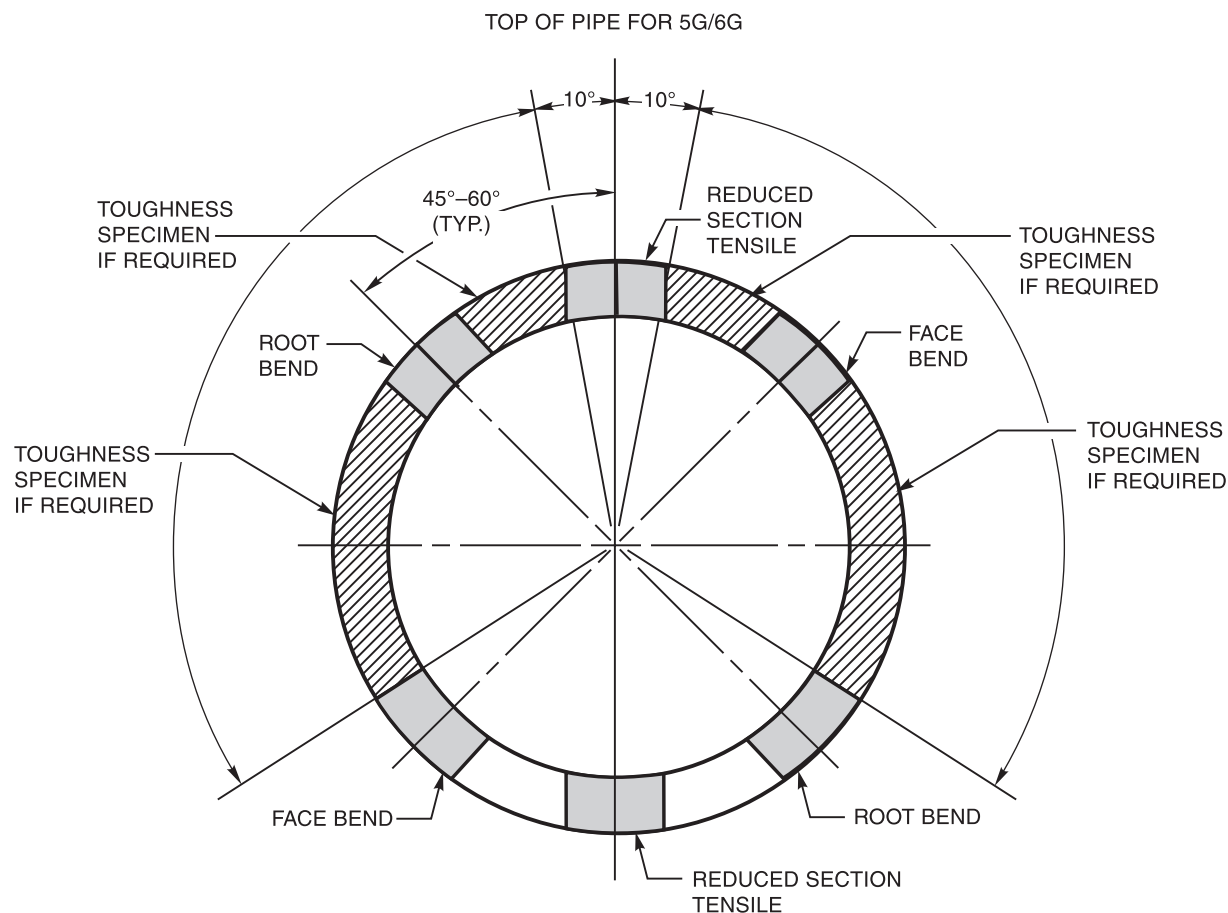
(2) The specified minimum tensile strength of the weld metal when the Referencing Document provides for the use of weld metal having a lower tensile strength than the base metal; or

(3) If the specimen breaks in the base metal outside of the weld or weld interface, the test shall be accepted, provided the strength is not more than 5% below the specified minimum tensile strength of the base metal; or

(4) If the base metal has no specified minimum tensile strength then failure in the base metal shall be acceptable.

4.7.6 Bend specimens shall be bent in one of the guided bend test fixtures shown in Annex B. For transverse specimens, the weld metal and heat-affected zone shall be completely within the bent portion of the specimen after bending. There shall be no open discontinuity exceeding 1/8 in [3 mm], measured in any direction on the convex surface of the specimen after bending. Cracks occurring on the corners of the specimen during bending shall not be considered, unless there is definite evidence that they result from weld discontinuities.

4.7.7 For fracture toughness testing, the type of test, number of specimens, and acceptance criteria shall be in accordance with the Referencing Document. The procedures and apparatus shall conform to the requirements of AWS B4.0, *Standard Methods for Mechanical Testing of Welds*. Specimen blanks shall be removed from test weldments in accordance with Figures 4.2, 4.3, 4.4, and 4.5, as applicable.



Notes:

1. Fracture toughness specimens, when required, shall be removed from the hatched sections.
2. Side bend specimens may be substituted for face and root bends for metal thickness from 3/8 in to 3/4 in [10 mm to 19 mm] inclusive. For metal thickness over 3/4 in [19 mm], side bends shall be used.
3. Dimensions for the specimen blanks and details of bend tests are shown in Annex B.
4. Material thickness shall be determined from the requirements provided in Table 4.3.

Figure 4.2—Location of Groove Weld Test Specimens—Pipe

4.8 Fillet Test Weldments and Acceptance Criteria

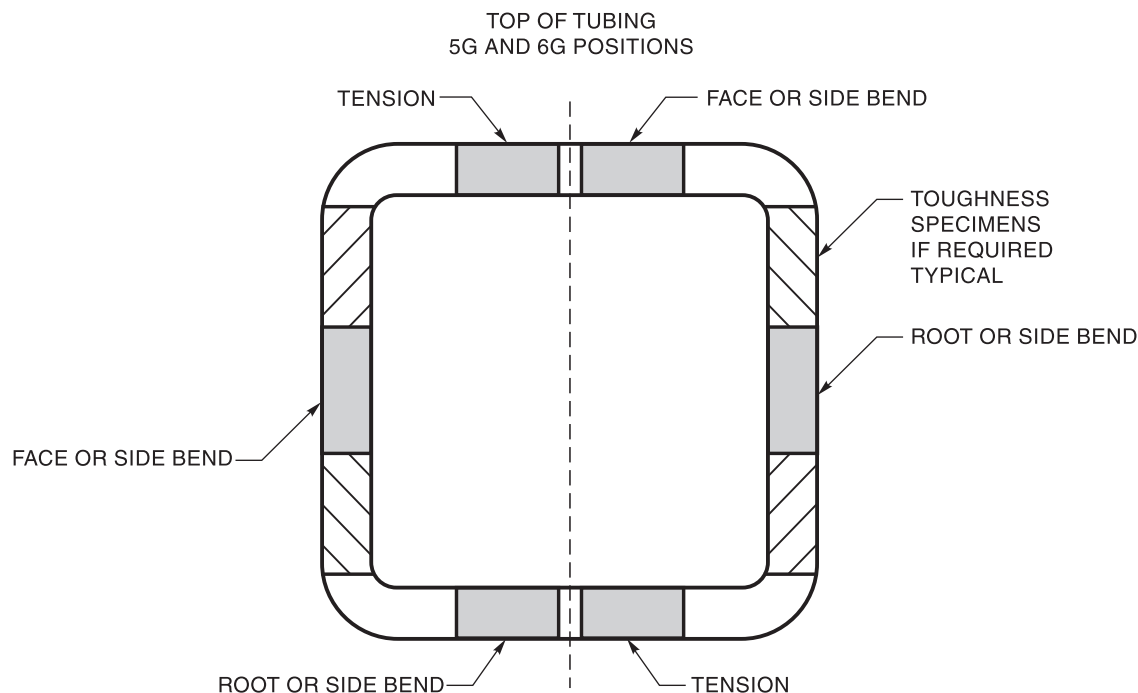
Unless otherwise stated in the Referencing Document or this document, test weldments shall be tested in accordance with AWS B4.0, *Standard Methods for Mechanical Testing of Welds*. Fillet welds may be qualified by fillet weld bend-break tests (see 4.8.5) or fillet weld shear tests (see 4.8.6).

4.8.1 Qualification of groove welds qualifies for fillet welds but not vice versa.

4.8.2 Fillet test weldment dimensions and test specimens are detailed in Figure 4.6 or 4.7, as appropriate.

4.8.3 Prior to removing specimen blanks for testing, the completed test weld shall be visually examined and meet the following criteria:

- (1) There shall be no cracks or incomplete fusion.
- (2) Undercut depth shall not exceed the lesser of 10% of the base metal thickness or 1/32 in [1 mm].
- (3) Profile and porosity limitations shall be in accordance with the Referencing Document.



Note: Material thickness shall be determined in accordance with Table 4.3.

Figure 4.3—Location of Test Specimens for Welded Box Tubing

4.8.4 Macroetch Test Specimen. There shall be no cracks, incomplete joint penetration, or incomplete fusion in the macro cross section.

4.8.5 Fillet Weld Bend-Break Test. If both single and multiple pass welds are to be qualified, one procedure qualification specimen shall be welded with the maximum size single pass to be used, and a second shall be welded with the minimum size multiple pass to be used. The test specimens are shown in Figure 4.7. Specimens shall be bent with the weld root in tension until the specimen either fractures or until it is bent flat upon itself. The specimen shall be accepted if it does not fracture or if the fillet fractures, the fractured surface shall exhibit no cracks or incomplete root fusion and no inclusion or porosity in the fracture surface exceeding 3/32 in [2 mm] in its greatest dimension. The sum of the greatest dimension of all inclusions and porosity shall not exceed 3/8 in [10 mm] in the specimen length.

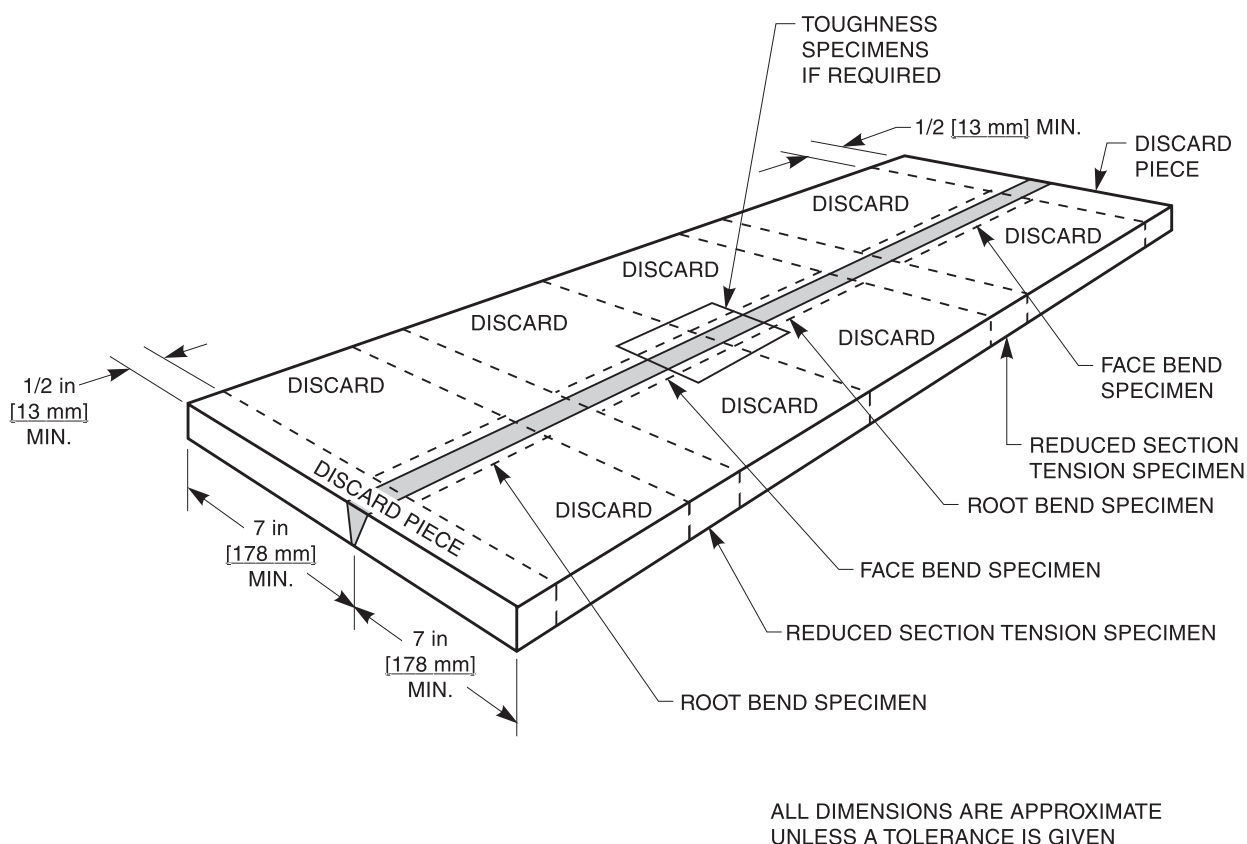
4.8.6 Fillet Shear Test. Unless otherwise stated in the Referencing Document, the fillet shear strength shall be not less than 60% of the lower of the minimum specified tensile strength of the base metal or weld metal. If neither value is available, two specimen blanks of the base

material shall be tension tested. The lowest value determined from these tests shall be the specified minimum tensile strength for qualification purposes. The minimum shear strength of aluminum fillet welds is listed in Table 4.5.

4.9 Cladding Test Weldment and Acceptance Criteria

4.9.1 The test weldment shall be welded as shown in Figure 4.8. The surface of the weld shall be prepared for liquid penetrant examination. Liquid penetrant examination shall be performed in accordance with ASTM E 165, *Standard Test Method for Liquid Penetrant Examination*. The surface shall be evaluated based on the following acceptance criteria:

- (1) There shall be no linear indications longer than 1/16 in [1.5 mm]
- (2) There shall be no more than four rounded indications in a line with dimensions greater than 1/16 in [1.5 mm] and separated from each other by less than 1/16 in [1.5 mm]



Notes:

1. Material thickness shall be determined in accordance with Table 4.3.
2. Dimensions for the specimen blanks and details of bend tests are shown in Annex B.
3. A longer test plate will be required if fracture toughness specimens are necessary. Fracture toughness specimens should be located near the midlength of the plate.
4. Make allowances for cutting.

Figure 4.4—Location of Tension, Longitudinal Bend, and Fracture Toughness Specimens—Plate

4.9.2 If the test weldment passes the liquid penetrant examination, specimen blanks shall be removed as shown in Figure 4.8.

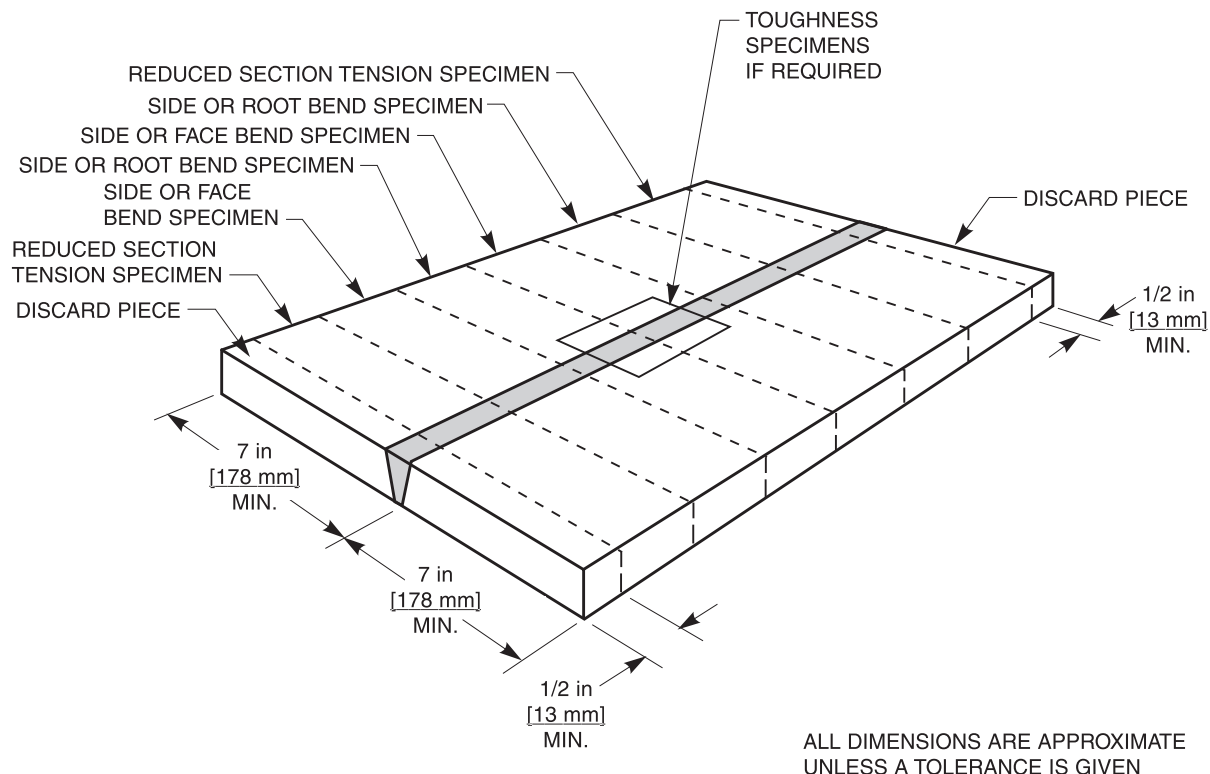
4.9.3 Bend specimens from cladding test weldments shall be prepared in accordance with Annex B, Figure B.4A of this specification, and bent in one of the guided-bend test fixtures shown in Figures B.5A through B.5C.

4.9.4 Weld cladding bend specimens shall have no open discontinuity exceeding 1/16 in [1.5 mm] in the cladding, measured in any direction on the convex surface, and no open defects exceeding 1/8 in [3 mm] in length at the weld interface after bending.

4.9.5 A chemical analysis sample shall be removed as shown in Figure B.4B, and the results from the chemical analysis specimen shall meet the requirements of the Referencing Document.

4.10 Hardfacing Test Weldment and Acceptance Criteria

4.10.1 The test weldment shall be welded as shown in Figure 4.9. The hardfaced surface shall be prepared for hardness testing at the minimum weld metal thickness to be qualified. Hardness testing shall be performed at three



Notes:

1. Material thickness shall be determined in accordance with Table 4.3.
2. Side bend specimens may be substituted for face and root bend specimens for metal thicknesses from 3/8 to 3/4 in [10 mm to 19 mm] inclusive. For metal over 3/4 in [19 mm] thick, side bend specimens shall be used. For GMAW-S short-circuiting transfer of base metals 3/8 in [10 mm] thick and greater, side bend tests shall be used to qualify the WPS.
3. Dimensions for the specimen blanks and details of permitted bend tests are given in Annex B.
4. A longer test plate will be required if fracture toughness specimens are necessary. Fracture toughness specimens should be located near the midlength of the test plate.

Figure 4.5—Location of Tension, Fracture Toughness, and Transverse Bend Specimens—Plate

locations, and the result of each test shall not be less than the minimum hardness specified in the Referencing Document.

4.10.2 If macroetch is required by the Referencing Document, the test weldment shall then be sectioned as shown in Figure 4.9. Both exposed faces shall then be polished and etched to provide a clear definition of the weld metal and the heat-affected zone in accordance with Annex G of this specification. Examination results from both faces shall meet the acceptance criteria of the Referencing Document.

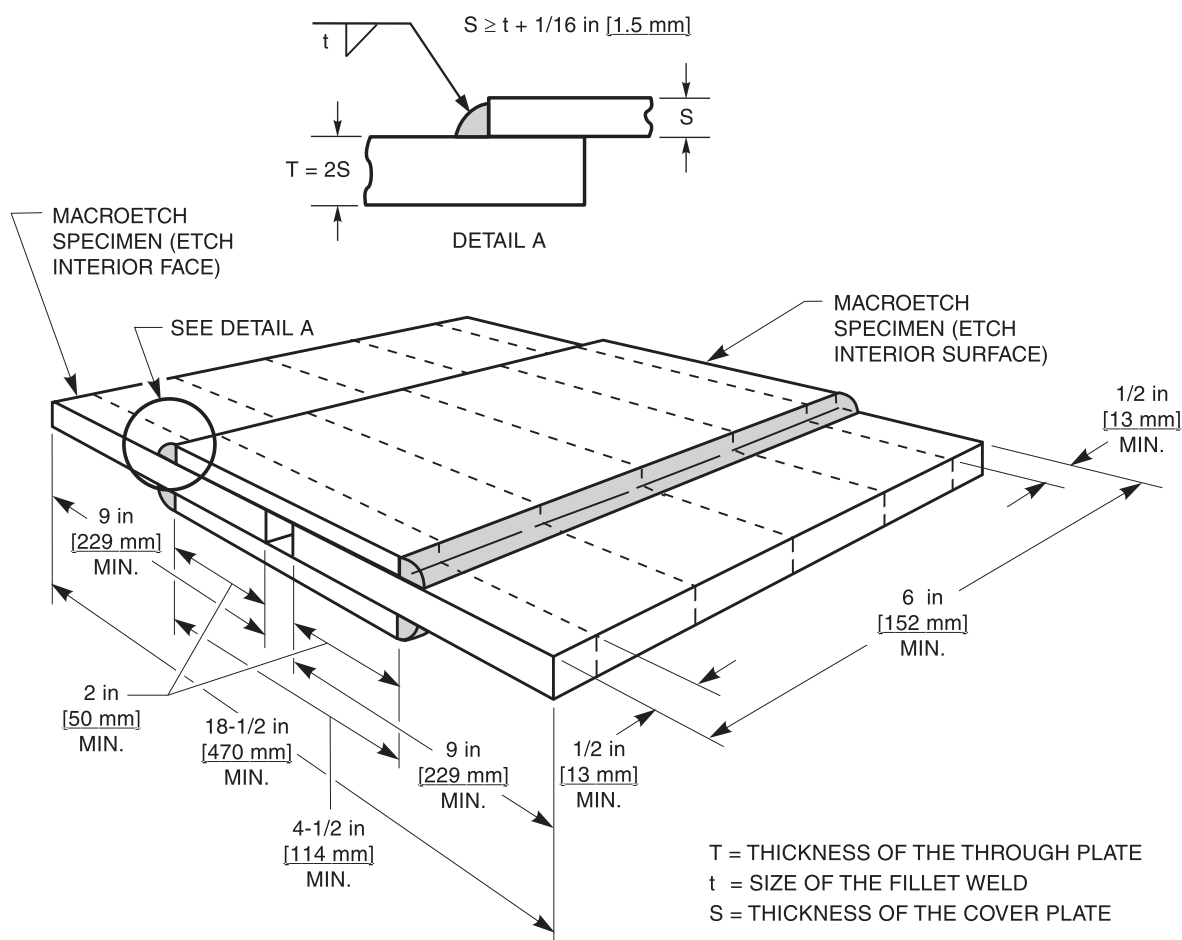
4.10.3 If specified by the Referencing Document, a sample for chemical analysis shall be obtained from one macroetch specimen as shown in Annex B, Figure B.4B.

4.11 Stud Welds and Acceptance Criteria

4.11.1 For studs welded to M-1 materials, ten welds are required to qualify each procedure. The following tests shall be applied to these welds:

- (1) Five bend specimens, and
- (2) Five tensile load specimens (or torque specimens).

4.11.2 For studs welded to other than M-1 materials, fifteen welds are required to qualify each procedure. The required tests are the same as provided in 4.11.1 for M-1 materials, except that five macroetch specimens are required in addition to the bend and tension specimens. Macroetch specimens shall consist of a cross section through the weld



Notes:

1. Length should be sufficient for the required number of specimens, which may be of any convenient width not less than 1 in [25 mm].
2. One edge of a shear test specimen shall be used for the required macro specimen. For GMAW-S short-circuiting transfer of base metals 3/8 in [10 mm] thick and greater, side bend tests shall be used to qualify the WPS.

Figure 4.6—Location of Fillet Weld Shear Test and Macroetch Specimens

on the stud centerline. Specimens shall be polished and etched to provide a clear definition of the weld metal and heat-affected zone in accordance with Annex G. There shall be no visible cracks on any of the five specimens.

4.11.3 Bend Tests. Studs shall be bent a minimum of 15° using a fixture similar to that shown in Annex B, Figure B.5D. Alternatively the studs shall be bent a minimum of 15° by hammer blows. Each of five welded studs shall be free of visible separation or fracture after bending.

4.11.4 Tensile Load Tests. Five stud welds shall be tested in a fixture similar to that shown in Annex B, Figure B.5F. Failure load shall be based on the minor diameter of the threaded section of externally threaded studs, except where the shank diameter is less than the minor

diameter, or on the original cross-sectional area where failure occurs in a nonthreaded, internally threaded, or reduced diameter stud. Each stud weld shall meet the strength requirements shown below, except a stud weld that breaks in the base metal outside of the weld or weld interface shall be acceptable.

(1) *Ferrous metals.* The failure strength shall be 35 000 psi [241 MPa], minimum.

(2) *Aluminum.* The failure load shall not be less than the values in Table 4.6.

(3) *Nonferrous metals.* Other than aluminum, the failure strength shall not be less than 1/2 of the minimum specified tensile strength of the stud.

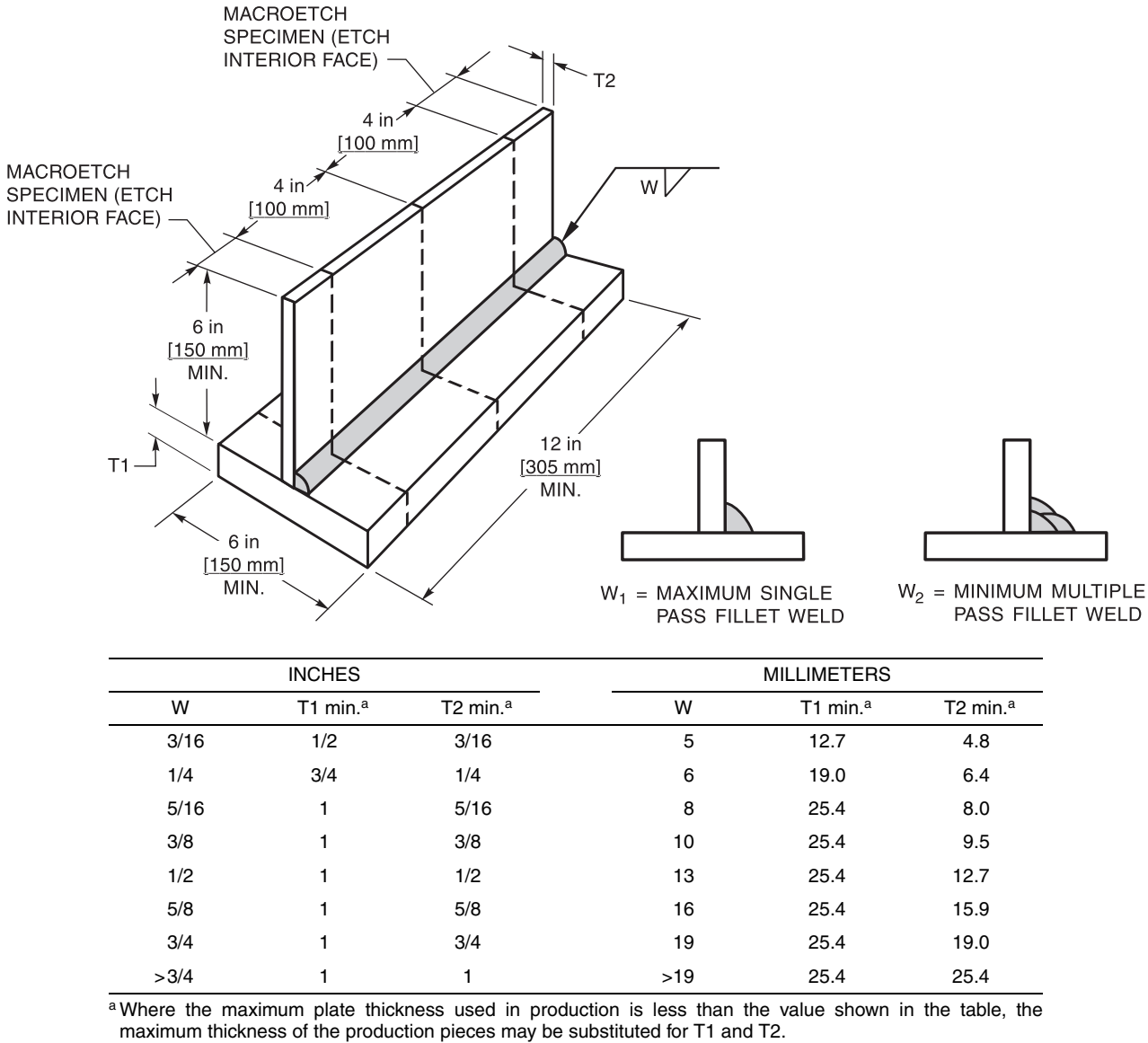


Figure 4.7—Fillet Weld Break Test and Macroetch Specimens for Procedure Qualification

Table 4.5
Minimum Shear Strength for Aluminum Fillet Welds

Filler Alloy	Shear Strength	
	ksi	MPa
1100	7.5	52
2319	16.0	110
4043	15.0	103
5183	28.0	193
5356	26.0	179
5554	23.0	159
5556	30.0	207
5654	18.0	124

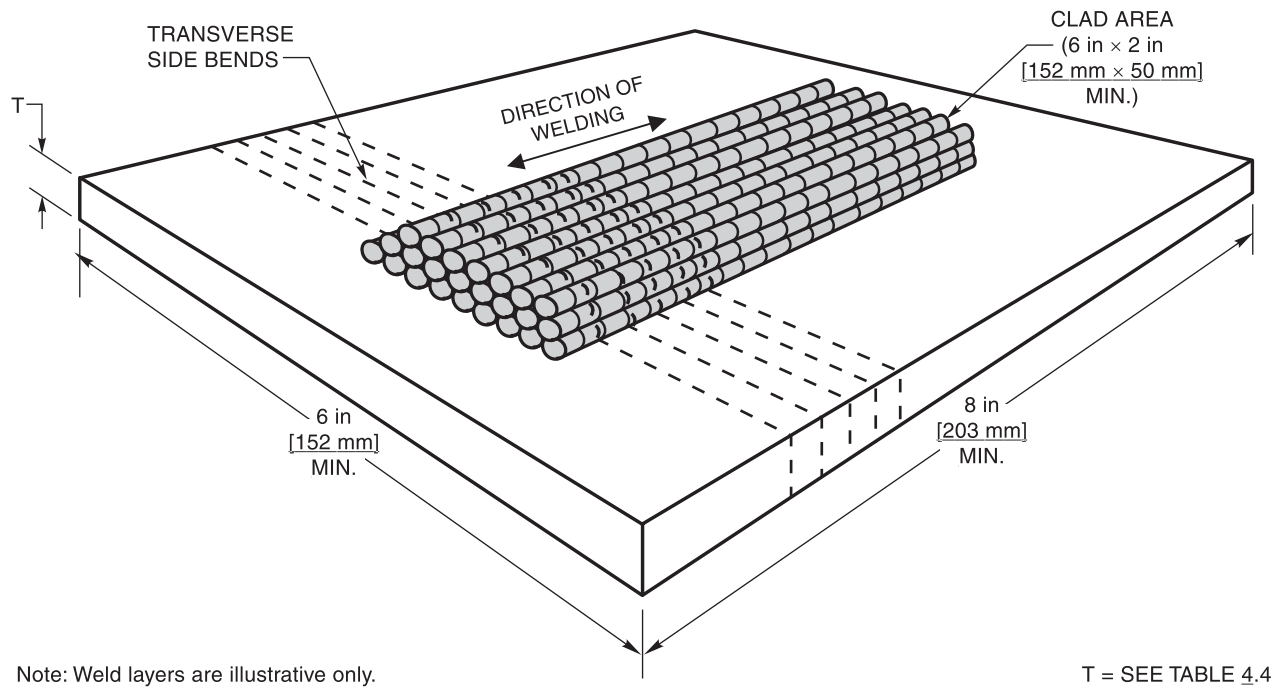


Figure 4.8—Location of Cladding Test Specimens

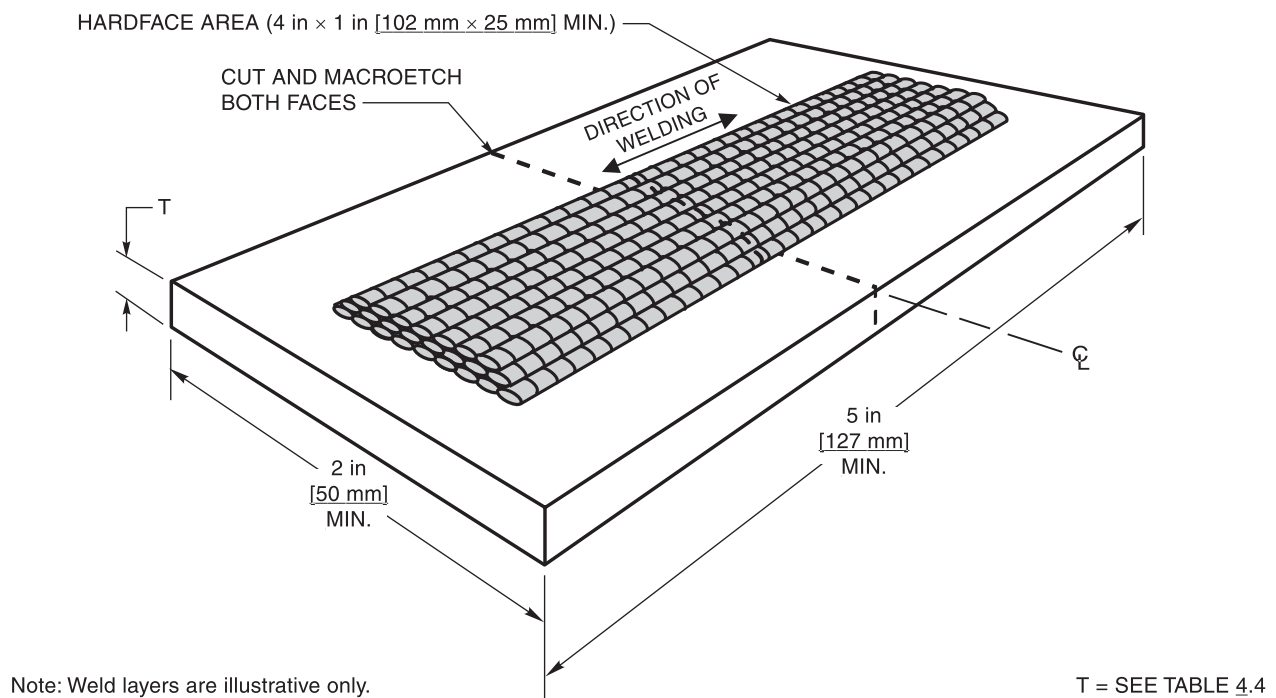


Figure 4.9—Location of Hardfacing Test Specimens

Table 4.6
Minimum Tensile Load Requirements for Aluminum Stud Welds

Stud Size	Stud Alloy	M-Number	Load	
			lb	N
6-32	1100	21	175	800
	5356	25	335	1500
8-32	1100	21	265	1200
	5356	25	550	2400
10-24	1100	21	340	1500
	5356	25	700	3100
10-32	1100	21	390	1700
	2319	24	1050	4700
1/4-20	1100	21	600	2700
	2319	24	1550	6900
	5356	25	1300	5800
	6061	23	1475	6600
5/16-18	1100	21	1075	4800
	5356	25	2200	9800
3/8-16	1100	21	1540	6900
	2319	24	3350	14 900
	5356	25	3175	14 100
7/16-14	5356	25	4300	19 100
1/2-13	5356	25	5800	25 800

4.11.5 Alternate Torque Test. Each of the five stud welds, in the unlubricated condition, shall resist the applicable torque shown in Table 4.7 for steel and Table 4.8 for aluminum before failure occurs. A test fixture similar to that shown in Annex B, Figure B.5E shall be used.

4.12 Test Weldments Less than 1/16 in [1.5 mm] Acceptance Criteria

4.12.1 The test weldment(s) shall be selected, depending upon the application, from those detailed in Figure 4.4 or 4.5. The required tests shall be in accordance with Table 4.1.

4.12.2 Completed groove test weldment(s) shall be visually examined and shall meet the following acceptance criteria:

- (1) No incomplete joint penetration or fusion.
- (2) Not more than one visible pore or inclusion exceeding 0.25 of the base metal thickness, shall be permitted in any 1 in [25 mm] of weld.
- (3) Visible pores shall not extend through the weld thickness.
- (4) The weld reinforcement shall not exceed 1/8 in [3 mm]
- (5) Undercut shall not exceed 0.15 times the thickness of the test weldment base metal. After visual examination, the test weldment(s) shall be subjected to the same tests required for groove welds in Table 4.1 and shall meet the following requirements for acceptance:

4.12.2.1 Tension test(s) shall demonstrate that the welded joint meets the minimum specified tensile strength of the base metal.

Table 4.7
Minimum Torque Requirements for Steel Stud Welds

Nominal Diameter		Thread	Torque	
in	mm		lb·ft	N·m
1/4	6	28 UNF	5	7
1/4	6	20 UNC	4	5
5/16	8	24 UNF	9	12
5/16	8	18 UNC	8	11
3/8	10	24 UNF	17	23
3/8	10	16 UNC	15	20
7/16	11	20 UNF	27	37
7/16	11	14 UNC	24	33
1/2	12	20 UNF	42	57
1/2	12	13 UNC	37	50
9/16	14	18 UNF	60	81
9/16	14	12 UNC	54	73
5/8	16	18 UNF	84	114
5/8	16	11 UNC	74	100
3/4	20	16 UNF	147	199
3/4	20	10 UNC	132	179
7/8	22	14 UNF	234	317
7/8	22	9 UNC	212	287
1	24	12 UNF	348	472
1	24	8 UNC	318	431

Table 4.8
Minimum Torque Requirements for Aluminum Stud Welds

Stud Size	Stud Alloy	M-No.	Torque	
			lb·in	N·m
6-32	1100	21	2.5	0.3
	5356	25	3.5	0.4
8-32	1100	21	5.0	0.6
	5356	25	7.5	0.8
10-24	1100	21	6.5	0.7
	5356	25	10.0	1.1
1/4-20	1100	21	21.5	2.4
	2319	24	60.0	6.8
	5356	25	32.5	3.7
	6061	23	55.0	6.2
5/16-18	1100	21	36.0	4.1
	5356	25	54.5	6.2
3/8-16	1100	21	53.0	6.0
	2319	24	135.0	15.3
	5356	25	81.0	9.2
7/16-14	5356	25	140.0	15.8

4.12.2.2 Bend tests may be conducted in a test fixture similar to Annex B, Figure(s) B.5A, B.5B, or B.5C, and shall be acceptable if there are no cracks evident in the base metal or weld metal exceeding 1/16 in [1.5 mm] after bending. Alternatively bend test(s) may consist of bending the specimen blank back upon itself, with the axis of the bend being parallel to the axis of the weld. Fractures or cracks resulting from bending shall show no evidence of weld related defects.

4.12.3 Completed fillet test weldment(s) shall be visually examined, and except for the first and last 1/2 in [13 mm] of weld shall meet the following acceptance criteria:

- (1) The weld shall have complete fusion.
- (2) Undercut shall not exceed 0.15 times the thickness of test weldment(s).

(3) Not more than one visible pore or inclusion exceeding 0.25 of the base metal thickness, shall be permitted in any 1 in [25 mm] of weld.

- (4) The weld shall be free of overlap or cracks.

4.12.4 After visual examination, the fillet test weldment shall be subjected to the tests required for fillet welds in Table 4.1 and shall meet the following requirements:

(1) The macro section specimen shall show complete fusion at the root and be free of cracks.

(2) If not stated in the Referencing Document, the shear test shall demonstrate a shear strength not less than 60% of the lower of the minimum specified base metal tensile strength or of the minimum specified weld metal tensile strength. The shear strength of aluminum welds is listed in Table 4.5.

4.13 Welding Procedure Specification Data

The following matrix indicates the welding data to be included in a WPS for each welding process. A WPS

may be presented in any format, written or tabular, provided the data required in this matrix are included (see 4.1.4). The WPS may list variables recorded on the PQR within the full range permitted for a qualification variable and practical limits determined by the Employer for other than qualification variables.

	E B W	E G W	E S W	F C A W	G M A W	G T A W	L B W	O F W	P A W	S A W	S M A W	S W
4.13.1 Joint Design												
(1) Joint type and dimensions.	X	X	X	X	X	X	X	X	X	X	X	
(2) Treatment of backside, method of gouging/ preparation.	X	X	X	X	X	X	X	X	X	X	X	
(3) Backing material, if used.	X	X	X	X	X	X	X	X	X	X	X	
(4) Size, shape, ferrule/flux type.												X
4.13.2 Base Metal												
(1) M-Number and Group Number.	X	X	X	X	X	X	X	X	X	X	X	X
(2) Thickness range qualified.	X	X	X	X	X	X	X	X	X	X	X	X
(3) Diameter (tubular only).	X	X	X	X	X	X	X	X	X	X	X	X
(4) The coating description or type, if present.	X	X	X	X	X	X	X	X	X	X	X	X
4.13.3 Filler Metal												
(1) <u>Specification, classification, F- and A-Number, or if not classified the nominal composition.</u>	X	X	X	X	X	X	X	X	X	X	X	
(2) Weld metal thickness by process and filler metal classification.				X	X	X		X	X	X	X	
(3) Filler metal size or diameter.	X	X	X	X	X	X	X	X	X	X	X	
(4) <u>Flux-electrode classification.</u>			X							X		
(5) <u>Penetration enhancing flux.</u>						X						
(6) Supplemental filler metal.	X	X	X	X	X	X	X		X	X		
(7) Consumable insert and type.						X			X			
(8) Consumable guide.		X	X									
(9) Supplemental deoxidant.	X						X					
(10) <u>Energized filler metal "hot."</u>						X			X			
4.13.4 Position												
(1) Welding position(s).	X	X	X	X	X	X	X	X	X	X	X	X
(2) Progression for vertical welding.	X			X	X	X	X	X	X	X	X	
4.13.5 Preheat and Interpass												
(1) Preheat minimum.	X			X	X	X	X		X	X	X	X
(2) Interpass temperature maximum (if applicable).	X			X	X	X	X		X	X	X	
(3) Preheat maintenance.	X			X	X	X	X		X	X	X	
4.13.6 Heat Treatment												
(1) PWHT temperature and time.	X	X	X	X	X	X	X	X	X	X	X	X

4.13.7 Shielding Gas

- (1) Torch shielding gas and flow rate range.
 (2) Root shielding gas and flow rate range.
 (3) Environmental shielding and vacuum pressure.

	E B W	E G W	E S W	F C A W	G M A W	G T A W	L B W	O F W	P A W	S A W	S M A W	S W
		X		X	X	X	X		X			X
						X			X			
	X						X					

4.13.8 Electrical

- (1) Current (or wire feed speed), current type, and polarity.
 (2) Voltage range (except for manual welding).
 (3) Beam focus current pulse frequency range, and filament type, shape and size.
 (4) Specification, classification, and diameter of tungsten electrode.
 (5) Transfer mode.
 (6) A change to or from pulsed current.

	X	X	X	X	X	X			X	X	X	X
	X	X	X	X	X	X			X	X		
	X											
						X			X			
				X	X							
				X	X	X			X		X	

4.13.9 Variables (see 4.14.9)

- (1) Welding process and whether manual, semiautomatic, mechanized, or automatic.
 (2) For mechanized or automatic, single or multiple electrode and spacing.
 (3) Single or multipass.
 (4) Contact tube to work distance.
 (5) Cleaning.
 (6) Peening.
 (7) Conventional or keyhole technique.
 (8) Stud gun model and lift.
 (9) Standoff distance for mechanized and automatic welding.
 (10) Backing shoe type.
 (11) Stringer or weave bead.
 (12) Travel-speed range for mechanized or automatic welding and manual applications requiring heat input calculations.
 (13) Fuel gas and flame type (oxidizing, neutral, or reducing).

	X	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X			X	X		
	X	X	X	X	X	X	X	X	X	X	X	
		X	X	X	X					X		
	X	X	X	X	X	X	X		X	X	X	X
		X	X	X	X	X			X	X	X	
	X						X		X			
	X						X		X			X
		X	X									
				X	X	X			X	X	X	
	X	X	X	X	X	X	X		X	X		
								X				

4.14 Procedure Qualification Variables

This matrix lists the procedure qualification variables to be recorded on the PQR for each welding process. A change in a procedure qualification variable beyond the limits shown in Table 4.14 shall require a new or revised WPS and a new PQR (see 4.1.8). The PQR shall list the actual values of the variables used. The key to the entries in the body of the table is as follows:

Q—Qualification variable for all applications

T—Qualification variable for all fracture toughness applications

C—Qualification variable for weld cladding applications

H—Qualification variable for hardfacing applications

4.14.1 Joint Design

- (1) A change in groove type (V-groove, U-groove, single bevel, etc.).
- (2) A change from a fillet to a groove weld.
- (3) A change in the M-Number of backing.
- (4) The addition of thermal backgouging on M-11, M-23, M-24, M-26, or M-27 heat-treatable base metal.
- (5) The addition or deletion of nonmetallic retainers or nonfusing metal retainers.
- (6) The addition or deletion of backing or backing shoes.
- (7) An increase in fitup gap beyond that used in the qualification test.

4.14.2 Base Metal

- (1) A change in base metal thickness beyond the range permitted in 4.5.
- (2) A change from one M-Number base metal to another M-Number base metal or to a combination of M-Number base metals, except as permitted in 4.3.10.
- (3) A change from one unlisted base metal to a different unlisted base metal or to a listed base metal or vice versa.
- (4) A change from one M-Number Group Number to any other M-Number Group Number, except as permitted in 4.3.11.
- (5) A change from one M-5 group (A, B, etc.) to any other. A change from M-9A to M-9B, but not vice versa. A change from one M-10 or M-11 group (A, B, etc.) to any other group.
- (6) A change from an uncoated metal to a coated (such as painted or galvanized) metal unless the coating is removed from the weld area prior to welding, but not vice versa, except as permitted in 4.3.8.

	E B W	E G W	E S W	F C A W	G M A W	G T A W	L B W	O F W	P A W	S A W	S M A W	S W
(1)	Q						Q					
(2)	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	
(3)	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	
(4)	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	
(5)		Q	Q									
(6)		Q	Q									
(7)	Q						Q					
(1)	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	
(2)	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
(3)	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
(4)	Q	T	T	T	T	T	Q		T	T	T	
(5)	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	
(6)	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q

4.14.3 Filler Metals

	E B W	E G W	E S W	F C A W	G M A W	G T A W	L B W	O F W	P A W	S A W	S M A W	S W
(1) A change from one F-Number to any other F-Number or to any filler metal not listed in Annex C.	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	
(2) For ferrous materials, a change from one A-Number to any other A-Number or to a filler metal analysis not listed in Annex C (the PQR and WPS shall state the nominal chemical composition, the AWS <u>specification</u> and classification, or the manufacturer's designation for filler metals which do not fall in an A-Number group). Qualification with A-1 shall qualify for A-2 and vice versa.	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	
(3) For surfacing, a change in the chemical composition of the weld metal (A-Number or alloy type). Each layer shall be considered independent of other layers.			C, H	C, H	C, H	C, H		C, H	C, H	C, H	C, H	
(4) A change in AWS filler metal <u>specification</u> and <u>classification</u> .	T	T	T	T	T	T	Q	Q	T	T	T	
(5) A change in filler metal tensile strength exceeding 10 000 psi [69 MPa], or a change in filler metal classified to a strength lower than the specified <u>minimum tensile</u> strength designator of the base metal.	Q	Q	Q	Q	Q	Q		Q	Q	Q	Q	
(6) If the weld metal alloy content is largely dependent upon the composition of the flux, any change in the welding procedure which would result in the important weld metal alloying elements being outside the specified chemical composition range of the WPS.			Q							Q		
(7) A change in the cross-sectional area of filler metal added (excluding buttering) of $\pm 10\%$.	Q						Q					
(8) The addition or deletion of filler material.	Q					Q	Q		Q			
(9) A decrease in thickness or a change in the nominal chemical composition of surfacing or buttering beyond that qualified.	C, H		C, H	C, H	C, H	C, H	C, H	C, H	C, H	C, H	C, H	
(10) A change of filler metal/electrode nominal size/shape in the first layer.				C, H	C, H					C, H	C, H	
(11) Addition or deletion of supplementary filler metal (powder or wire), or a change of 10% in the amount.	T	T	T	T	Q	T	Q	Q	Q	Q	T	
(12) A change from single to multiple supplementary filler metal or vice versa.				C, H	C, H	C, H		C, H	C, H	C, H		
(13) A change from consumable guide to nonconsumable guide, and vice versa.			Q									

	E B W	E G W	E S W	F C A W	G M A W	G T A W	L B W	O F W	P A W	S A W	S M A W	S W
4.14.3 Filler Metals (Cont'd)												
(14) Addition or deletion, or a change in the nominal amount or composition of supplementary metal (in addition to filler metal) beyond that qualified.		Q			Q					Q		
(15) A change from wire to strip electrodes and vice versa.			Q							Q		
(16) A change from one AWS flux-electrode classification listed to any other electrode-flux-electrode classification, or to an unlisted electrode-flux classification. A variation of 0.5% of the molybdenum content of the weld metal does not require requalification.			Q							Q		
(17) A change in the weld metal thickness beyond that permitted in 4.5.	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	
(18) The addition or deletion, or a change in the nominal amount or composition of supplementary deoxidation material beyond that qualified.	Q						Q					
4.14.4 Position												
(1) A change from any position to the vertical position, uphill progression. Vertical uphill progression qualifies all positions.				T	T	T			T		T	
(2) The addition of a welding position, except that positions other than flat also qualify for flat.				C, H	C, H	C, H		C, H	C, H	C, H	C, H	Q
4.14.5 Preheat and Interpass Temperature												
(1) A decrease in preheat of more than 100°F [38°C] from that qualified.	Q			Q	Q	Q	Q		Q	Q	Q	Q
(2) An increase of more than 100°F [38°C] in the maximum interpass temperature from that recorded on the PQR.				T	T	T			T	T	T	
(3) For M-23, M-24, M-26, and M-27 heat-treatable materials an increase in the preheat or interpass temperature of more than 100°F [38°C] from that qualified.					Q	Q			Q		Q	
4.14.6 Postweld Heat Treatment												
(1) For the following M-Numbers 1, 3, 4, 5, 6, 7, 9, 10, 11, and 12, a change from any one condition to any other requires requalification:	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
(a) No PWHT.												
(b) PWHT below the lower transformation temperature.												
(c) PWHT within the transformation temperature range.												

	E B W	E G W	E S W	F C A W	G M A W	G T A W	L B W	O F W	P A W	S A W	S M A W	S W
4.14.6 Postweld Heat Treatment (Cont'd)												
(d) PWHT above the upper transformation temperature.	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
(e) PWHT above the upper transformation temperature, followed by treatment below the lower transformation temperature.												
(2) For all materials not covered above, a separate PQR is required for no PWHT and PWHT.	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
(3) The qualification test weldment shall be subjected to heat treatment essentially equivalent to that of the production weldment, including at least 80% of the aggregate time at temperature.	T	T	T	T	T	T		T	T	T	T	
4.14.7 Shielding Gas												
(1) Addition or deletion of torch shielding gas.		Q		Q	Q	Q	Q		Q			Q
(2) A change in the specified nominal composition of shielding gas.		Q		Q	Q	Q	Q		Q			Q
(3) A change of shielding environment from vacuum to an inert gas <u>or vice versa</u> .	Q						Q					
(4) An increase in vacuum pressure.	Q											
(5) A change in shielding, as a result of a change in ferrule or flux type.												Q
(6) For M-51, M-52, M-61, and M-10I base metal, a change in the nominal composition or a decrease of 15% in the root shielding flow rate.					Q	Q			Q			
(7) For M-21 through M-27, an increase of 50% or more, or a decrease of 20% or more in the shielding gas flow rate used for qualification.					Q	Q			Q			
(8) The addition, deletion, or a change in composition, or a decrease exceeding 15% in the flow rate of root shielding gas on single-sided M-4X groove joints and for all welds in M-51 through M-54, M-61 and M-62, M-10I, M-10J, and M-10K.					Q	Q			Q			
(9) For M-10I, M-51 through M-54, and M-61 and M-62, the deletion of, or a change in composition of, or a decrease exceeding 10% in the trailing gas flow rate.					Q	Q	Q		Q			
(10) The addition, deletion, a 5% flow rate change for any gas used in the process, or a change in the orientation of the plasma-removing gas jet relative to the workpiece (e.g., coaxial transverse to beam).							Q					

4.14.8 Electrical Characteristics

- (1) An increase in heat input or volume of weld metal deposited per unit length of weld, over that qualified, except when a grain refining austenitizing heat treatment is applied after welding. The increase may be measured by either of the following:

(a) Heat input (J/in [J/mm]) =

$$\frac{\text{Volts} \times \text{Amps} \times 60}{\text{Travel Speed (in/min [mm/min])}}$$

(b) Weld Metal Volume—An increase in bead size, or a decrease in the length of weld bead per unit length of electrode.

- (2) A change exceeding $\pm 2\%$ in the voltage from that qualified.
- (3) A change exceeding $\pm 5\%$ in the beam or beam focus current from that qualified.
- (4) A change in the beam pulsing frequency or duration from that qualified.
- (5) A change in filament type, size, or shape.
- (6) A change in the type of power source, or a change in the arc timing exceeding 1/10 second, or a change in amperage exceeding $\pm 10\%$ from that qualified.
- (7) A change in the mode of metal transfer from short circuiting to globular, spray, or pulsed and vice versa.

4.14.9 Other Variables

- (1) A change in welding process.
- (2) A change in the number of electrodes in the same weld pool.
- (3) A change from multipass per side to single pass per side.
- (4) A change from the conventional welding to keyhole welding, or vice versa, or, the inclusion of both techniques unless each has been individually qualified.
- (5) A change in the stud gun model, or a change exceeding 1/32 in [1 mm] in the nominal lift.
- (6) A change exceeding $\pm 5\%$ in gun-to-workpiece distance, or axis of beam angle related to work.
- (7) A change exceeding $\pm 20\%$ in oscillation length or width from that qualified, or the addition of a cosmetic wash pass.

	E B W	E G W	E S W	F C A W	G M A W	G T A W	L B W	O F W	P A W	S A W	S M A W	S W
(1) An increase in heat input or volume of weld metal deposited per unit length of weld, over that qualified, except when a grain refining austenitizing heat treatment is applied after welding. The increase may be measured by either of the following:	T	T	T	T	T	T	T		T	T	T	
(a) Heat input (J/in [J/mm]) =												
$\frac{\text{Volts} \times \text{Amps} \times 60}{\text{Travel Speed (in/min [mm/min])}}$												
(b) Weld Metal Volume—An increase in bead size, or a decrease in the length of weld bead per unit length of electrode.												
(2) A change exceeding $\pm 2\%$ in the voltage from that qualified.	Q											
(3) A change exceeding $\pm 5\%$ in the beam or beam focus current from that qualified.	Q											
(4) A change in the beam pulsing frequency or duration from that qualified.	Q											
(5) A change in filament type, size, or shape.	Q											
(6) A change in the type of power source, or a change in the arc timing exceeding 1/10 second, or a change in amperage exceeding $\pm 10\%$ from that qualified.												Q
(7) A change in the mode of metal transfer from short circuiting to globular, spray, or pulsed and vice versa.				Q	Q							
(1) A change in welding process.	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
(2) A change in the number of electrodes in the same weld pool.		Q	Q	T	T	T			T	T		
(3) A change from multipass per side to single pass per side.	Q			T	T	T	Q		T	T	T	
(4) A change from the conventional welding to keyhole welding, or vice versa, or, the inclusion of both techniques unless each has been individually qualified.									T			
(5) A change in the stud gun model, or a change exceeding 1/32 in [1 mm] in the nominal lift.												Q
(6) A change exceeding $\pm 5\%$ in gun-to-workpiece distance, or axis of beam angle related to work.	Q											
(7) A change exceeding $\pm 20\%$ in oscillation length or width from that qualified, or the addition of a cosmetic wash pass.	Q											

4.14.9 Other Variables (Cont'd)

	E B W	E G W	E S W	F C A W	G M A W	G T A W	L B W	O F W	P A W	S A W	S M A W	S W
(8) A change in design or material of backing shoes.	Q	Q	Q									
(9) A change exceeding $\pm 20\%$ in the oscillation variables for mechanized or automatic welding.				T	T	T			T	T		
(10) A change exceeding $\pm 10\%$ in travel speed for mechanized or automatic welding.				C, H	C, H	C, H			C, H	C, H		
(11) A change from stringer bead to weave bead for manual welding.				C, H	C, H	C, H			C, H	C, H	C, H	
(12) A change from a stringer to a weave bead, but not vice versa, for M-23, M-24, M-26, and M-27 heat-treatable materials.					Q	Q			Q			
(13) A change from a stringer bead to a weave bead in vertical uphill welding.				T	T	T			T		T	
(14) A change in the nominal size or shape of the stud at the section to be welded.												Q
(15) A change in the type of fuel or type of flame.								Q				
(16) A change from single-sided welds to double-sided or vice versa.	Q						Q					

5. Performance Qualification

5.1 General

The purpose of welder qualification testing is to determine the ability of welders to produce a sound weld in the welding test positions. The purpose of welding operator qualification tests is to determine the ability of welding operators to operate mechanized or automatic equipment.

5.1.1 Qualification of welders and welding operators requires that a weldment shall be made according to a Standard Welding Procedure Specification (SWPS) or a qualified Welding Procedure Specification (WPS). The weldment shall be prepared and tested in accordance with the requirements of this specification. If the WPS requires preheat or PWHT, they may be omitted at the discretion of the Qualifier.

5.1.2 Welders and welding operators qualified to earlier editions of AWS B2.1 are also qualified to the current edition.

5.1.3 Personnel currently qualified by the Employer to meet the requirements of other codes or specifications are considered qualified under AWS B2.1 provided the basis for their qualification meets all requirements of this specification. However, the limits of qualification shall be in accordance with 5.6, Performance Qualification Variables. In such cases, a certification form shall be initiated and signed by the Employer attesting to compliance with this specification. If an existing form is used, the certifying statement shall be added or appended. If a new form is issued, it shall reference any prior certification form which shall be attached to or traceable from the new form.

5.1.4 Qualification testing using one of two methods is permitted:

(1) Qualification by Standard Test (see 5.2)

(2) Qualification by Workmanship Test (see 5.3). For selection of performance qualification methods, see Figure 5.1.

5.1.5 A Standard Test shall qualify the individual to perform production welding where either a Standard Test or a Workmanship Test is specified. Where the Referencing Document permits qualification by visual examination, a Workmanship Test may qualify a welder or welding operator for production welding.

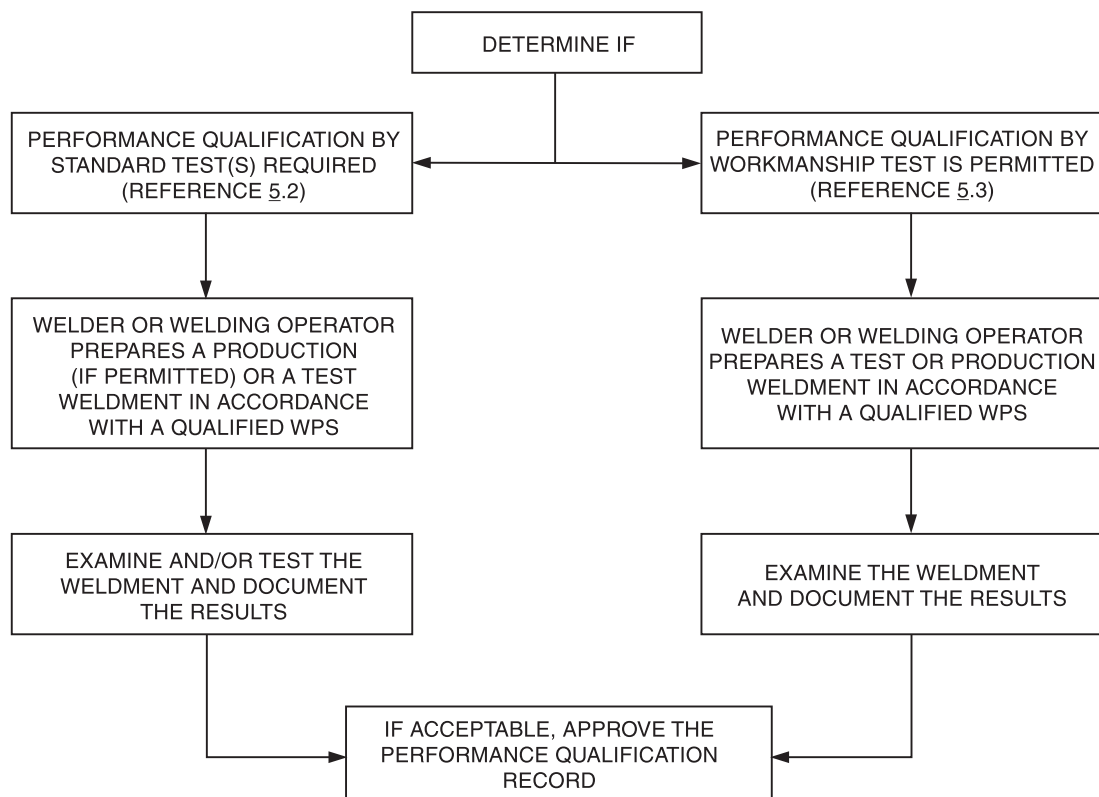
5.1.6 A Workmanship Test is permitted on a production weldment, if such qualification is also permitted by the Referencing Document. Qualification by Standard Test is also permitted to be performed on a production weld where Table 5.1 permits the use of radiography in lieu of bend tests. Production radiography shall meet the requirements of 5.5.2, Radiographic Examination.

5.1.7 The welder or welding operator undertaking performance qualification tests shall be under the full supervision and control of the Qualifier during the welding of test weldments.

5.1.8 The qualification test for each welder or welding operator shall be documented by the Qualifier for both acceptable and unacceptable tests (see example in Annex E). There is no required format for Performance Qualification Test Records (PQTR). Any PQTR form may be used. Documentation shall:

- (1) Identify the WPS used;
- (2) Address each of the qualification variables in 5.6, Performance Qualification Variables;
- (3) Identify test and examination methods used and results; and
- (4) Identify the limits of qualification for the welder or welding operator.

5.1.9 Acceptance of test results is the responsibility of the Qualifier. Qualification records shall be signed and dated by the Qualifier. Qualification records shall reference and may include mechanical test and nondestructive examination test reports that are signed by others. Retention of mechanical test and nondestructive examination test reports is not required after acceptance by the Qualifier.



Note: Figure 5.1 is provided to aid the user in determining the type of examinations or tests that are required to qualify a welder or welding operator using this specification.

**Figure 5.1—Selection of Performance Qualification Method—
Workmanship Test or Standard Test**

**Table 5.1
Examination Requirements for Performance Qualification^d**

Type of Test	Pipe or Plate <u>Less than</u> <u>1/16 in [1.5 mm]</u>		Pipe or Plate <u>Equal to or</u> <u>Greater than 1/16 in [1.5 mm]</u>		Surfacing	
	Groove	Fillet	Groove	Fillet	Cladding	Hardfacing
Visual Examination	Yes	Yes	Yes	Yes	Yes	Yes
Radiography	Yes ^a (in lieu of bends)		Yes ^a (in lieu of bends)			
Bend Test	Yes ^a		Yes ^a		Yes	
Break Test ^c		Yes		Yes ^c		
Macro-Examination ^b				Yes ^c		Yes

^a Radiography may be substituted for bend testing for the SMAW, GTAW, GMAW (except short-circuiting), FCAW, PAW, and SAW processes, as applicable, for qualifications on all base metals except M-51 to M-55 and M-61 to M-62. GTAW tests in M-51 to M-55 and M-61 to M-62 may be qualified with radiography.

^b The use of a macro examination in lieu of bend tests shall be permitted only for welds made in M-26, M-81, and M-83 base materials.

^c The requirement for a break test and macro is waived for welders who successfully complete fillet procedure qualification tests (where shear tests, plus visual and macro examinations are used).

^d See Table 5.2.

5.1.10 A welder or welding operator who fails the performance test may be retested at the option of the Qualifier, using (1) or (2) below:

(1) If a retest is permitted by the Qualifier without further training or practice, it shall consist of two test weldments for each position failed. Both test weldments shall be acceptable for the welder or welding operator to qualify.

(2) Provided there is evidence satisfactory to the Qualifier that the welder or welding operator has had further training or practice, one test weld for each position failed is permitted.

5.1.11 The performance qualification of a welder or welding operator shall be affected when one of the following conditions occur:

(1) When he or she has not welded with a process during a period of 6 months or more, his or her qualifications for that process shall expire.

(2) Requalification as a result of (1) is permitted by having the welder or welding operator make one test weldment using the same process. If the test weldment meets the requirements of this specification, then all of the welder's or welding operator's previous qualifications for that process, for materials, thicknesses, product forms, and other variables are reinstated.

(3) When there is a specific reason to question his or her ability to make welds that meet the specification, the qualifications which support the welding he or she is doing shall be revoked. All other qualifications not questioned remain in effect.

(4) Requalification as a result of (3) is permitted by having the welder or welding operator successfully complete performance qualification test(s) that support the qualification(s) questioned.

5.1.12 Completion of an acceptable procedure or performance qualification test shall qualify the welder or welding operator who welded the test weldment within the limits of performance qualification variables specified in 5.6, Performance Qualification Variables.

5.1.13 Successful qualification using the test WPS shall also qualify an individual to weld with any other WPS using the same process and within the limits of performance variables in 5.6, Performance Qualification Variables. Qualification as a welder does not qualify the individual as a welding operator or vice versa.

5.1.14 Qualification on a complete joint penetration groove weld also qualifies the welder or welding operator for partial joint penetration groove welds and fillet welds. Qualification on a partial joint penetration groove

weld qualifies only for partial joint penetration groove welds and fillet welds. Qualification on a fillet weld qualifies only for fillet welding.

5.1.15 Welders qualified on a groove weld are also qualified to perform weld build up of surfaces to replace or repair base material with similar composition weld metal within the limits of 5.6.1.1, Welders. Cladding qualification qualifies only for cladding. Hardfacing qualification qualifies only for hardfacing.

5.1.16 Performance qualification requirements for cast iron and for reinforcing bar are covered in AWS D11.2, *Guide for Welding Iron Castings*, and in AWS D1.4/D1.4M, *Structural Welding Code—Reinforcing Steel*, respectively.

5.2 Qualification by Standard Test

5.2.1 Qualification requires completion of a standard test weldment in accordance with a qualified WPS, evaluation of the test weldment by the methods listed in Table 5.1, and acceptance of the weldment in accordance with the criteria of 5.5, Examination Procedures and Acceptance Criteria. The number of bend tests required for each position and product form is shown in Table 5.2.

5.3 Qualification by Workmanship Test

5.3.1 Qualification by workmanship test is permitted only when allowed by the Referencing Document.

5.3.2 Qualification requires completion of a workmanship test welded in accordance with a qualified WPS which addresses typical production joints and conditions.

Table 5.2
Number of Bend Tests
for Performance Qualification

	Product Form			
	Plate	Pipe	Tube	Sheet
1G	2	2	2	2
2G	2	2	2	2
3G	2	—	—	2
4G	2	—	—	2
5G	—	4	4	—
6G	—	4	4	—

Workmanship weldments are accepted or rejected primarily on the basis of the visual examination criteria of 5.5, Examination Procedures and Acceptance Criteria. Other tests or examinations (macro examination, etc.) may be specified by the Referencing Document. Some typical workmanship test weldments are shown in Figure 5.2.

5.4 Test Weldments

5.4.1 Qualification is valid only for metals having the same M-Numbers, except as otherwise permitted in Table 5.3.

5.4.2 Tests shall be performed using a filler metal which has an assigned F-Number listed in Annex C. Table 5.4 provides a matrix showing filler metals which, if used in qualification testing, will qualify that welder and welding operator to use other filler metals without further testing. A test using a filler metal not assigned an F-Number in Annex C shall qualify only for that filler metal.

5.4.3 Test coupons welded in the specific test positions described in Annex B1.1 and B1.3 qualify the welder to weld plate or pipe as permitted in Table 5.5. Weldment orientation other than the specific test positions shown in Annex B is permitted, but such tests qualify only for the orientation tested. Figures B.1B and B.1D show the permitted angular deviation in weld axis inclination and weld face rotation for each test position passed.

5.4.4 One or more welding process may be qualified on a single test weldment. Multiple welders and welding operators may be qualified for specific portions of one test. Failure of any portion of such test weldments constitutes failure for all processes, welders and welding operators used in that test weldment.

5.4.5 Figures 5.3 through 5.13 illustrate the various performance test weldments which are permitted, and give the locations for the removal of required specimen blanks.

5.4.6 Cladding. The clad weldment shall be visually examined in accordance with 5.5, Examination Procedures and Acceptance Criteria. If acceptable, the clad surface shall be machined to the minimum weld metal thickness specified in the WPS. Two bend specimens are required except that 6G cladding pipe performance qualification requires three bend specimens, and the 2G cladding pipe performance qualification requires only one bend specimen.

5.4.7 Hardfacing. Prior to removing test specimen blanks identified in Figure 5.13, the hardfaced surface

shall be visually examined in accordance with the Referencing Document. Unless otherwise specified in the Referencing Document one transverse macro shall be removed as shown in Figure 5.13, and the weld shall show complete fusion.

5.5 Examination Procedures and Acceptance Criteria

Unless otherwise specified in the Referencing Document, examination procedures and acceptance criteria shall be as specified in the following paragraphs.

5.5.1 Visual Examination. The test weld may be examined visually by the Qualifier at any time, and the test terminated at any stage if the necessary skills are not exhibited. The completed test weld shall be visually examined without magnification.

5.5.1.1 Standard Test Weldments. Acceptance criteria for visual examination of standard test weldments shall be as follows:

(1) Plate and Pipe Weldments

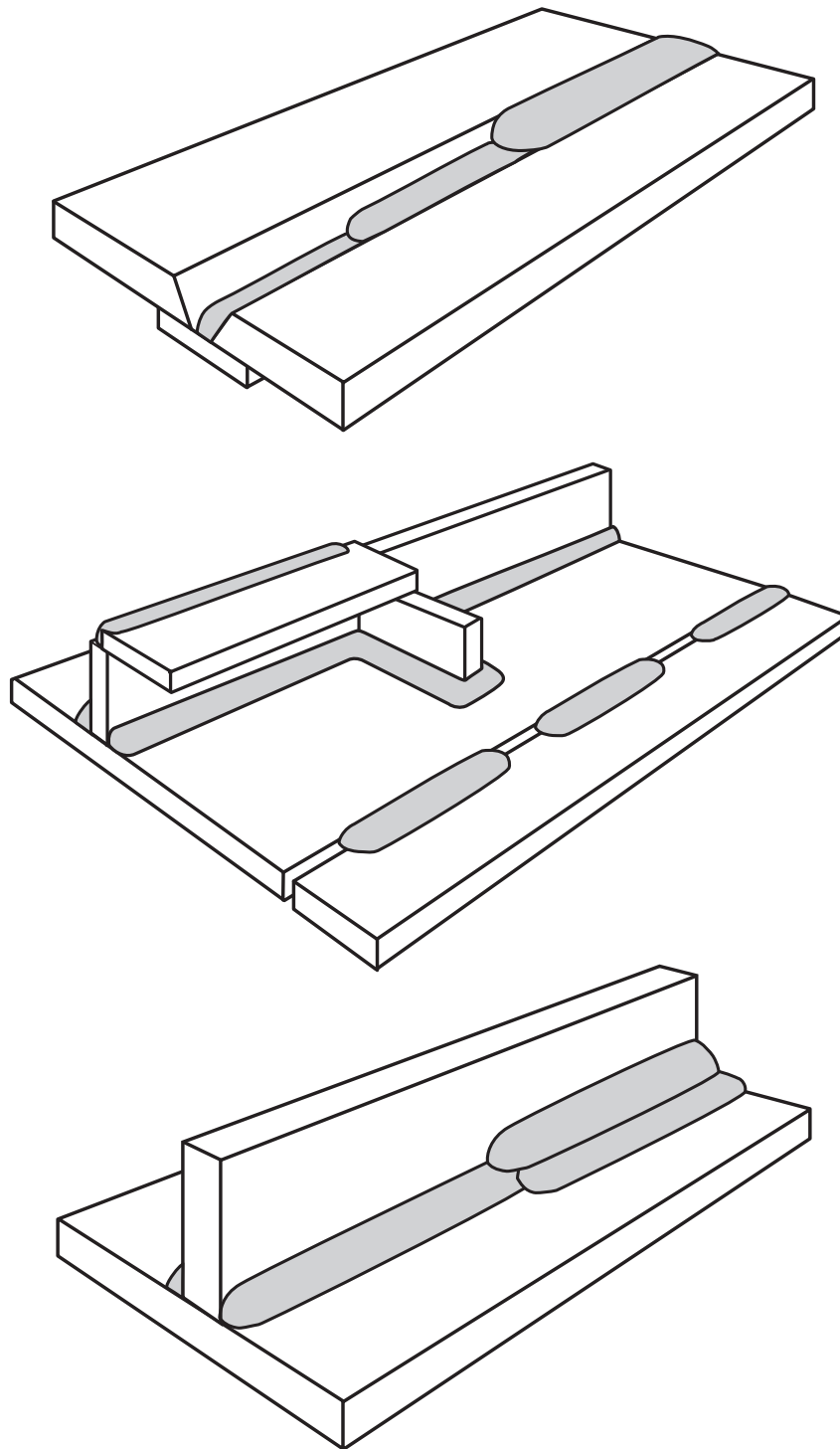
- (a) No cracks or incomplete fusion.
- (b) No incomplete joint penetration in groove welds, except where partial joint penetration groove welds are specified.
- (c) Undercut depth shall not exceed the lesser of 10% of the base metal thickness or 1/32 in [1 mm].
- (d) Face reinforcement or root reinforcement shall not exceed 1/8 in [3 mm].
- (e) No single pore shall exceed 3/32 in [2 mm] diameter.
- (f) For fillet weld tests, concavity or convexity of the weld face shall not exceed 1/16 in [1.5 mm]. The two fillet leg sizes shall not differ by more than 1/8 in [3 mm].

(2) Cladding/Hardfacing Weldments

- (a) The appearance of the weld shall satisfy the Qualifier that the welder is skilled in applying the WPS used for the test weldment.

(3) Test Weldments Less than 1/16 in [1.5 mm] Base Metal Thickness

- (a) No cracks or incomplete fusion.
- (b) No melt-through (burn-through) which results in a hole.
- (c) No weld reinforcement for groove welds or convexity for fillet welds that exceed 1/8 in [3 mm].
- (d) No visible porosity or inclusions.



Note: The top figure illustrates a weldment intended to demonstrate ability to weld a groove weld with a backing strip. The center figure shows a weldment intended to demonstrate ability to weld fillet, corner, and square groove joints. The bottom figure shows a weldment intended to demonstrate ability to weld single and multi-pass welds.

Figure 5.2—Typical Workmanship Test Weldments

Table 5.3
Allowable Base Metals
for Performance Qualification

Test Weldment Material ^a	Qualifies for Production Welding Materials ^b
M-1 through M-11, M-34, and M-41 through M-47	M-1 through M-11, and M-41 through M-47 and M-34
M-21 through M-27	Any M-21 through M-27 material
M-31 through M-33 and M-35	Only the specific M-Number used in the qualification test
M-34 or M-42	Any M-34 and M-41 through M-47 material
M-51 through M-54 and M-61 and M-62	M-51 through M-54 and M-61 and M-62
M-81 or M-83	Any M-81 and M-83

^a If materials not listed in Annex D are used for qualification tests, the welder or welding operator shall be qualified to weld only on the material used in the test weldment.

^b Also qualifies unlisted materials of similar chemical composition to the test materials.

Table 5.4
Allowable Filler Metals
for Performance Qualification

Filler Metal Used in Qualification Test	Qualifies a Welder and a Welding Operator to Use the Filler Metals Listed Below
F-Number 1 through 5	The F-Number used in the test and any lower F-Number
F-Number 6 ^a	All F-Number 6 filler metals
F-Number 2X	All F-Number 2X filler metals
F-Number 3X	Only for the specific F-Number 3X filler metal
F-Number 4X	F-Number 1 through 5 and all F-Number 4X
F-Number 5X	All F-Number 5X filler metals
F-Number 61	All F-Number 61 filler metals
F-Number 71	Only for the specific F-Number 71 filler metal
F-Number 91	All F-Number 91 filler metals

^a Deposited solid bare wire, which is not covered by an AWS specification but which conforms to an A-Number analysis in Annex C, Table C.2, may be considered classified as F-Number 6.

5.5.1.2 Workmanship Test Weldments. Acceptance criteria for visual examination of workmanship test weldments shall be as specified below. If visual examination is the only criterion for acceptance, all weld beads are subject to examination.

(1) No cracks or incomplete fusion.

(2) Undercut shall not exceed the lesser of 10% of the base metal thickness or 1/32 in [1 mm]. Except that 1/16 in [1.5 mm] undercut is acceptable if less than 1/4 in [6 mm] long, provided the accumulated length of such undercut is less than 3/4 in [19 mm] in any 12 in [305 mm] of weld.

(3) Reinforcement shall not exceed 1/8 in [3 mm].

(4) No single pore shall exceed 3/32 in [2 mm] diameter.

5.5.2 Radiographic Examination. Unless otherwise specified in the Referencing Document, the radiographic procedure and acceptance criteria shall be in accordance with Annex E.

5.5.3 Bend Tests. Specimens shall be bent in one of the guided-bend test fixtures shown in Figures B.5A, B.5B, and B.5C.

5.5.3.1 For face bend specimens, the weld face side shall be on the convex side of the bend specimen. For root bend specimens, the weld root side shall be on the convex side of the bend specimen. Side bend specimens may be bent in either direction. For all transverse bend specimens, the weld metal and heat-affected zone shall be completely within the bent portion of the specimen after bending.

5.5.3.2 Bend specimens from groove welds shall have no open discontinuity exceeding 1/8 in [3 mm], measured in any direction on the convex surface of the specimen after bending. Cracks occurring on the corners of the specimen during bending shall not be considered, unless there is definite evidence that they result from slag inclusions or other discontinuities.

5.5.3.3 For weld cladding, no open discontinuity exceeding 1/16 in [1.5 mm] measured in any direction on the surface shall be permitted in the cladding, and no open defects exceeding 1/8 in [3 mm] in length shall be permitted at the weld interface after bending.

5.5.4 Fillet Weld Bend-Break Tests. Specimens shall be bent with the weld root in tension until the specimen either fractures or until it is bent flat upon itself. The specimen shall be accepted if:

(1) The specimen does not fracture; or

(2) If the fillet fractures, the fractured surface shall exhibit no cracks or incomplete root fusion and no inclusion or porosity in the fracture surface exceeding 3/32 in [2 mm] in its greatest dimension; or

(3) The sum of the greatest dimension of all inclusions and porosity do not exceed 3/8 in [10 mm] in the specimen length.

5.5.5 Macro Examination. Specimens shall be polished and etched to provide a clear definition of the weld metal and heat-affected zone (see Annex G). Visual examination of etched surfaces shall be without magnification.

(1) *Fillet Welds.* Both weld cross sections of the macroetch specimen from the fillet weld shall be examined. The weld cross section shall show no incomplete fusion and no cracks. Discontinuities at the weld root, not exceeding 1/32 in [1 mm], shall be acceptable.

(2) *Hardfacing.* The specimen shall show complete fusion.

5.6 Performance Qualification Variables

5.6.1 Qualification on one WPS will also qualify for welding with any other WPS within the limits given in 5.4 and the following performance qualification variables.

5.6.1.1 Welders. A change in any variable listed below from that which was used in a welder's qualification test will require requalification of that welder:

(1) A change in welding process except that welders qualified with GMAW spray, pulsed spray, or globular transfer are also qualified to weld with gas shielded FCAW and vice versa.

(2) The deletion of backing.

(3) A change in filler metal F-Number except as allowed in 5.4.2.

(4) A change in base metal except as permitted in 5.4.1.

(5) For OFW, a change in the type of fuel gas.

(6) For GTAW, a change from alternating to direct current or vice versa, or a change in polarity.

(7) A change in position from that qualified, except as permitted in 5.4.3.

(8) A change in vertical weld progression from uphill to downhill, or vice versa for any pass except root passes that are completely removed by back gouging or final passes used to dress the final weld surface.

(9) For GMAW, a change from spray transfer, globular transfer, or pulsed spray welding to short-circuiting transfer; or vice versa.

(10) For GMAW, GTAW, or PAW, omission or addition of consumable inserts, or deletion of root shielding gas except for double welded butt joints, partial penetration groove, and fillet welds.

(11) A change in thickness or diameter from that tested except as permitted in Tables 5.6, 5.7, and 5.8.

5.6.1.2 Welding Operator. A change in any variable listed below from that which was used in the welding operator's qualification test will require requalification of the welding operator:

(1) A change in welding process except that welding operators qualified with GMAW spray, pulsed spray, or globular transfer are also qualified to weld with gas shielded FCAW and vice versa.

(2) A change from direct visual to remote visual control or vice versa.

(3) A change in position except as permitted in Table 5.5.

(4) Deletion of consumable inserts.

(5) For GMAW welding a change from any transfer mode to the short-circuiting mode.

(6) A change in base metal except as permitted in 5.4.1.

Table 5.5
Position Limitations for Performance Tests

		Qualified Positions ^{c, e}			
Test Positions ^f		Groove		Fillet	Clad and Hardfacing
Weld	Position	Plate and Pipe Over 24 in [610 mm] O.D.	Pipe ≤24 in [610 mm] O.D.	Plate and Pipe	Plate and Pipe
Plate Groove	1G	F		F, H	—
	2G	F, H		F, H	—
	3G	F, V		F, H, V	—
	4G	F, O		F, H, O	—
	3G and 4G	F, V, O		All	—
	2G, 3G, and 4G	All		All	—
Plate Fillet	1F	—	—	F	—
	2F	—	—	F, H	—
	3F	—	—	F, H, V	—
	4F	—	—	F, H, O	—
	3F and 4F	—	—	All	—
Pipe Groove ^{a, b}	1G	F	F	F, H	—
	2G	F, H	F, H	F, H	—
	5G	F, V, O	F, V, O	All	—
	6G	All	All	All	—
	2G and 5G	All	All	All	—
Pipe-Fillet	1F	—	—	F	—
	2F	—	—	F, H	—
	2FR	—	—	F, H	—
	4F	—	—	F, H, O	—
	5F	—	—	All	—
Clad or Hardfacing ^d (Pipe or Plate) ^e	1C	—	—	—	F
	2C	—	—	—	F, H
	3C	—	—	—	F, V
	4C	—	—	—	F, O
	3C and 4C	—	—	—	F, V, O
	2C, 3C, and 4C	—	—	—	All
	5C (pipe only)	—	—	—	F, V, O
	6C (pipe only)	—	—	—	All

^a Welders qualified on tubular product forms may weld on both tubular and plate in accordance with any restrictions on diameter contained in other portions of this document.

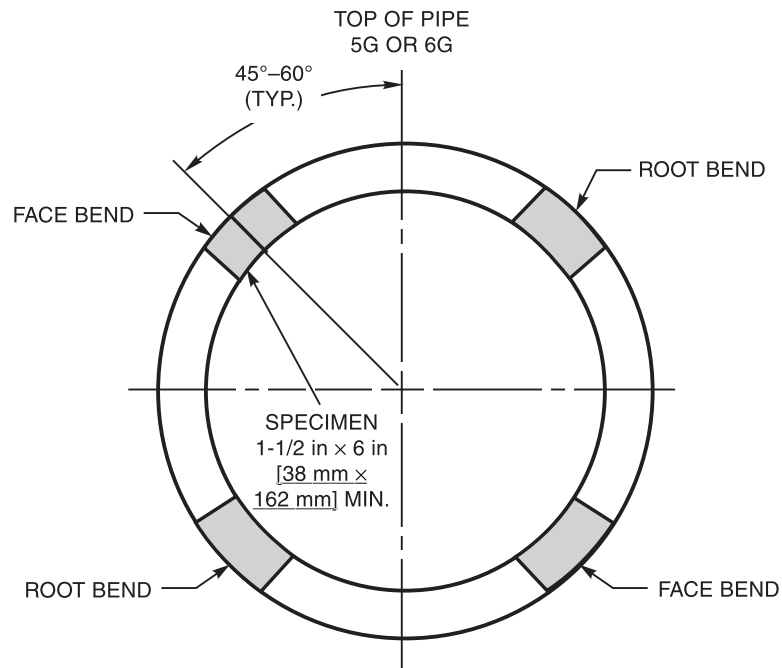
^b See Table 5.6.

^c F = Flat, H = Horizontal, V = Vertical, O = Overhead. Refer to B1.2, B1.4, and Figures B.1B and B.1D of Annex B.

^d Positions for surfacing applications are defined as 1C = Flat, 2C = Horizontal, 3C = Vertical, 4C = Overhead, 5C = Circumferential pipe horizontal position, 6C = Circumferential pipe joint with pipe inclined 45°.

^e For surfacing applications, qualification on plate qualifies for plate only except that qualification on plate in the flat position also qualifies on pipe in the flat position. Qualification on pipe in any position shown above for cladding or hardfacing also qualifies for plate in the positions allowed in the table.

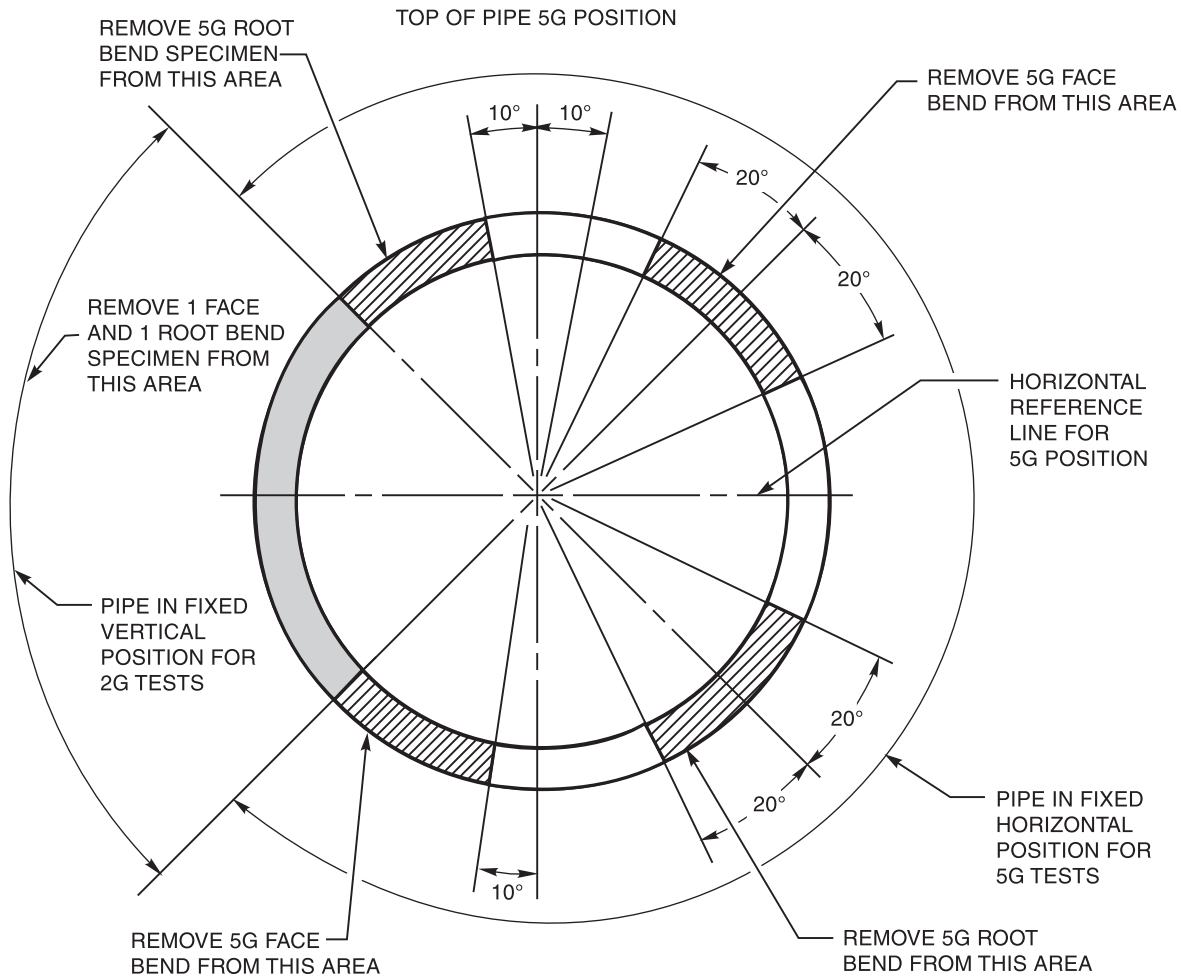
^f Refer to B1.1 and B1.3 for welding test position definitions.



Notes:

1. For pipe over 3/8 in [10 mm] thick, side bends may be taken in lieu of face and root bends. For base metals which exceed 3/4 in [19 mm], side bends shall be taken.
2. See Table 5.6 for diameter and thickness limitations.

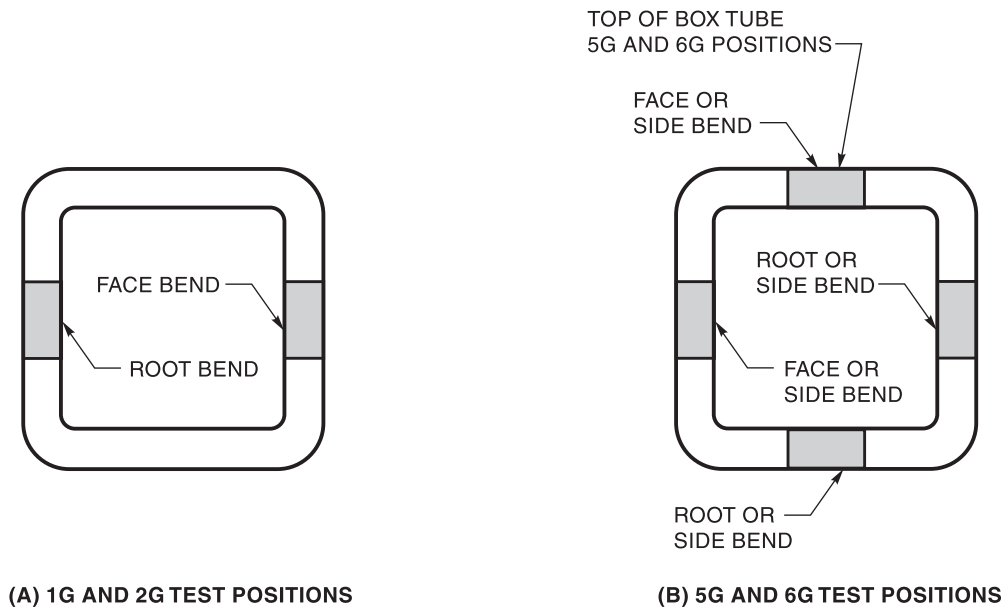
Figure 5.3—Location of 1G, 2G, 5G, and 6G Bend Specimens—Pipe Groove Weldment



Notes:

1. For pipe over 3/8 in [10 mm] thick, side bends may be taken in lieu of face and root bends. For base metal thicknesses which exceed 3/4 in [19 mm], side bends shall be taken.
2. See Table 5.6 for diameter and thickness limitations.
3. Six specimen blanks shall be removed from the appropriate locations shown, 1 face and 1 root bend specimen from the 2G portion of the test weldment and 2 face and 2 root bend specimens from the 5G portion of the test weldment.
4. Dimensions for the specimen blanks and details of bend tests are shown in Annex B.

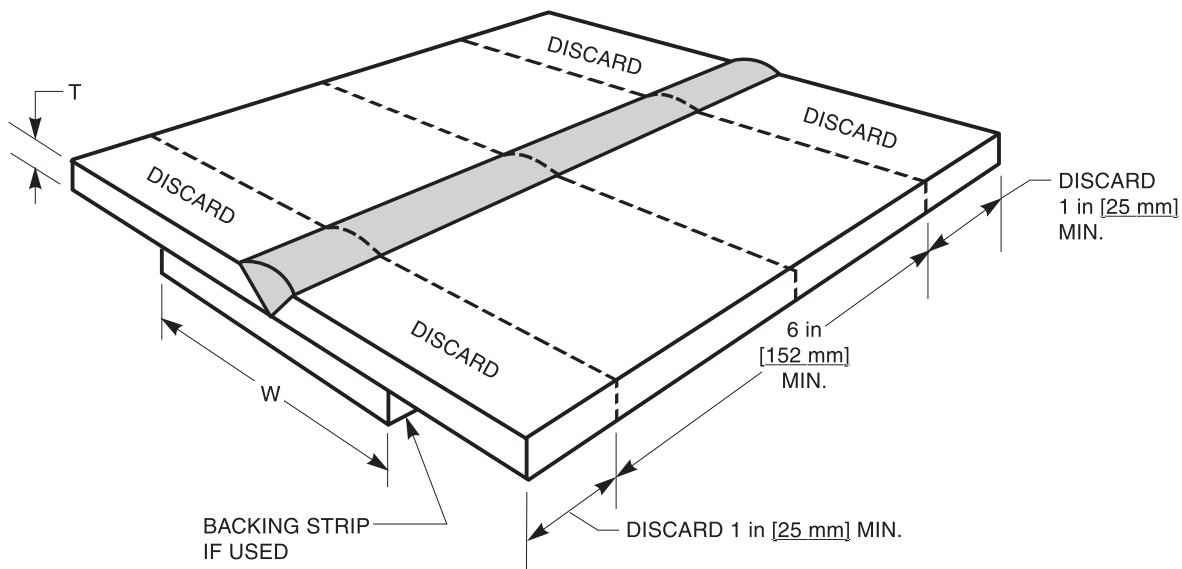
Figure 5.4—Location of Bend Specimens—Combined Pipe Positions 2G and 5G



Notes:

1. For pipe over 3/8 in [10 mm] thick, side bends may be taken in lieu of face and root bends. For base metals which exceed 3/4 in [19 mm], side bends shall be taken.
2. The outside diameter of square and rectangular tube is defined as the shortest distance across opposite sides.
3. See Table 5.6 for diameter and thickness limitations.

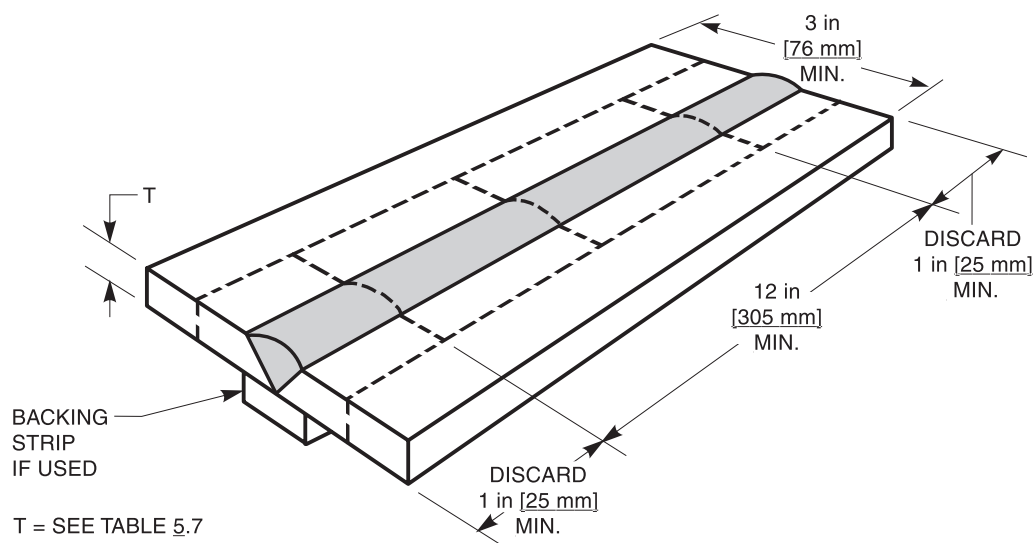
Figure 5.5—Location of Bend Specimens for Box Tube



Notes:

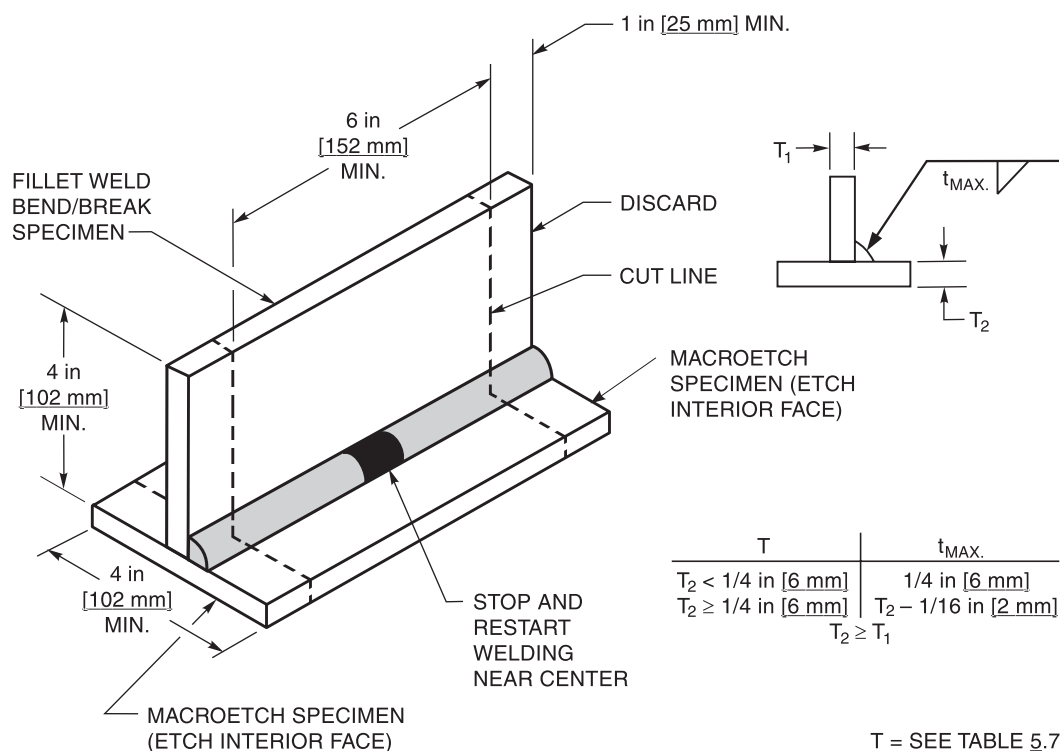
1. Longitudinal bend specimens as shown in Figure 5.7 may be substituted for transverse bend specimens for welds that differ markedly in bending behavior between two base metals or between base metal and weld metal.
2. For thicknesses (T) from 3/8 in to 3/4 in [10 mm to 19 mm], side bends may be substituted for the face and root bends shown. For thicknesses over 3/4 in [19 mm], side bends shall be used. The specimens and their order of removal shall be the same for weldments with or without the optional backing strip shown in these drawings.
3. Dimensions of test specimens and detail of test fixtures are shown in Annex B.
4. Backing width (W) shall be 3 in [76 mm] minimum if radiography is used.

Figure 5.6—Location of Transverse Bend Specimens—Plate Groove Weldment



Note: Dimensions of test specimens and test fixtures are shown in Annex B.

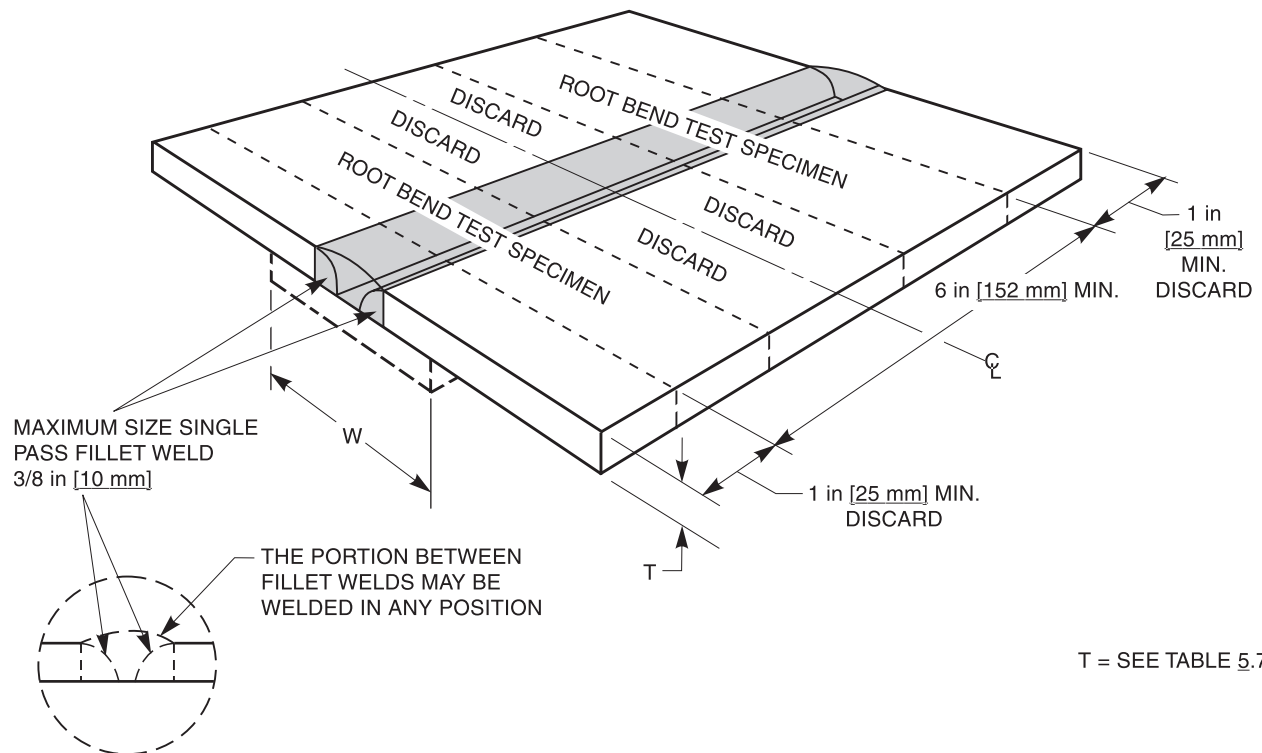
Figure 5.7—Location of Longitudinal Bend Specimens—Plate Groove Test Weldment



Notes:

1. The center 6 in [152 mm] segment shall be bent with the root in tension until it fractures or bends flat.
2. One of the end pieces shall be selected for the macroetch specimen.

Figure 5.8—Location of Fillet Test Specimens—Plate



Notes:

1. Longitudinal bend specimens as shown in Figure 5.7 may be substituted for transverse bend specimens for welds that differ markedly in bending behavior between two base metals or between base metal and weld metal.
2. Dimensions of test specimens and detail of test fixtures are shown in Annex B.
3. Backing width (W) shall be 3 in [76 mm] minimum if radiography is used.

Figure 5.9—Location of Fillet Test Specimens—Alternate Weldment—Plate

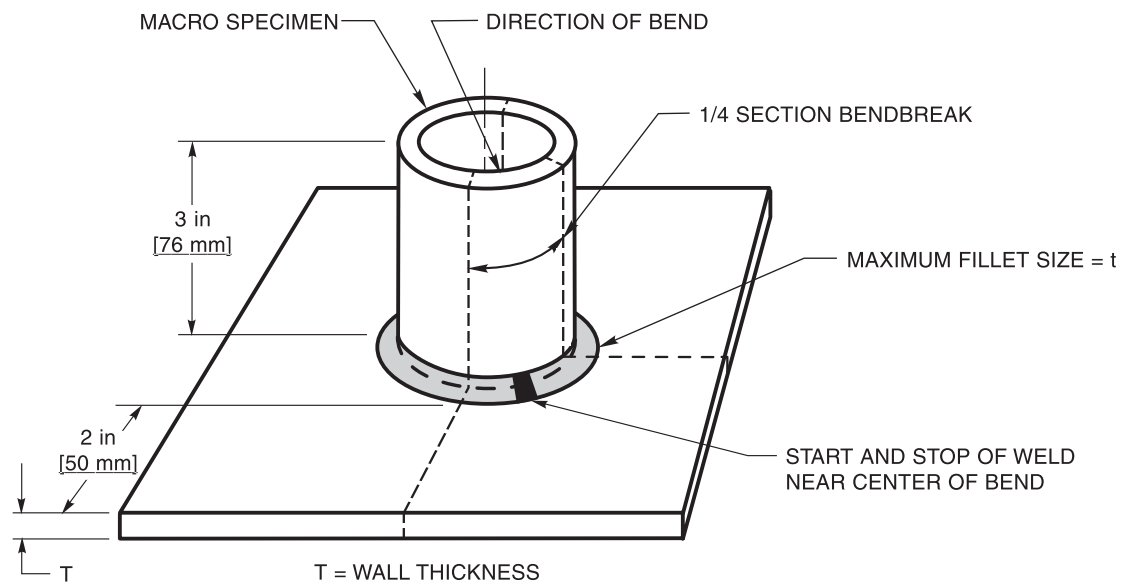
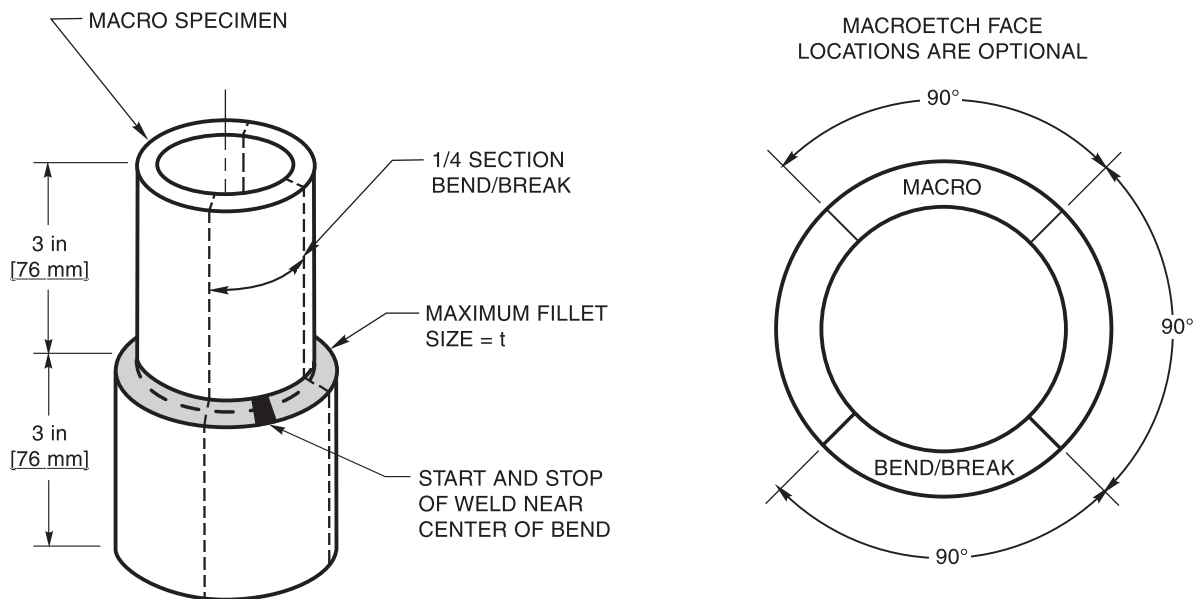
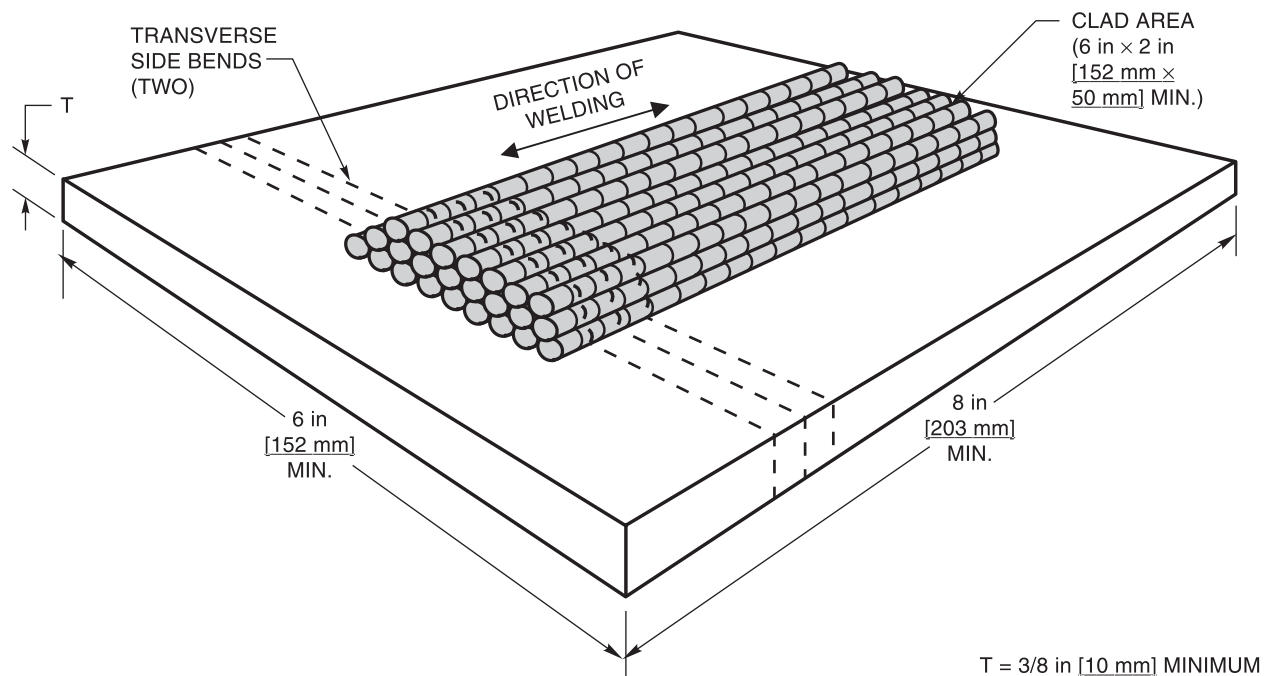


Figure 5.10—Location of Fillet Test Specimens—Pipe



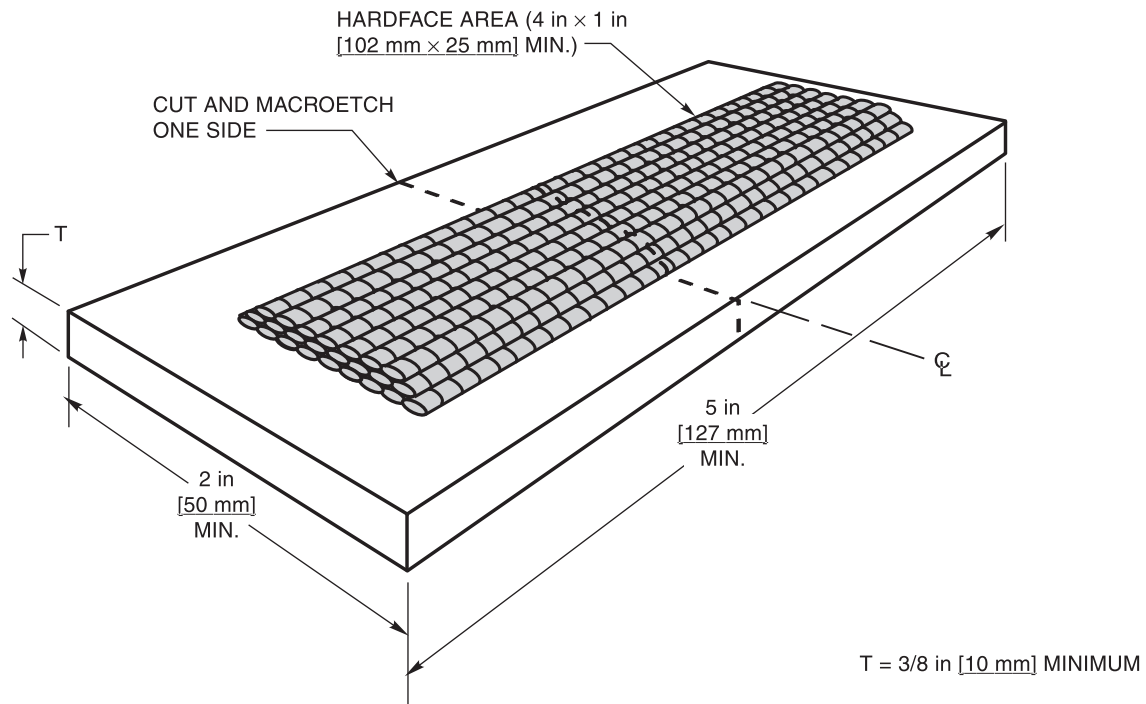
Note: The bend/break specimen shall be removed from the lower 90° for 5F weldments.

Figure 5.11—Location of Fillet Test Specimens—Alternate Weld—Pipe



Note: Weld layers are illustrative only. Two transverse side bend specimen shall be removed from the test coupon for each position for which the welder is being qualified, except as otherwise required in 5.4.6.

Figure 5.12—Location of Cladding Specimens—Plate



Note: Weld layers are illustrative only. One transverse macro specimen shall be removed from the test coupon for each position for which the welder is being qualified, except as otherwise permitted in Table 5.5.

Figure 5.13—Location of Test Specimen—Hardfacing Test Weldment—Plate

Table 5.6
Limitations for Performance Qualification on Groove Welds in Pipe and Tube

Test Weldment, in [mm]		Qualifies for Pipe and Plate			
		Minimum Outside Diameter, in [mm]		Maximum Deposit Thickness	
Outside Diameter	Deposit Thickness (t)	Grooves	Fillet	Grooves	Fillet
Less than 1 [25]		Size welded	All		
1 through 2-7/8 [25 through 73]		1 [25]	All		
Over 2-7/8 [73]		2-7/8 [73]	All		
	Less than 3/4 [19]			2t	All
	3/4 [19] and over			Unlimited	All

t = thickness of the deposited weld metal

Note: For GMAW-S, the maximum weld metal thickness deposited shall not exceed 1.1 times the thickness of weld metal deposited by the GMAW-S process in the qualification test. For base metals 3/8 in [10 mm] thick and greater, side bends are required for GMAW-S.

Table 5.7
Limitations for Performance Qualification in Plate Groove Welds

Test Weldment Thickness (T), in [mm]	Qualifies for Plate	
	Deposit Thickness (t), Maximum	Fillet Weld Size
<3/4 [19]	2t	Unlimited
≥3/4 [19]	Unlimited	Unlimited

Notes:

1. Qualification on plate will also qualify for groove welds in pipe over 24 in [610 mm] in diameter.
2. For GMAW-S, the maximum weld metal thickness deposited shall not exceed 1.1 times the thickness of weld metal deposited by the GMAW-S process in the qualification test. For base metals 3/8 in [10 mm] thick and greater, side bends are required for GMAW-S.

Table 5.8
Limitations for Performance Qualification in Pipe Fillet Welds

Test Weldment, in [mm]	Qualifies for Fillets		
	Outside Diameter, in [mm]	Fillet Weld Size	Base Metal Thickness
Pipe less than 1 [25] outside diameter	Size welded and over	Unlimited	Unlimited
Pipe 1 to 2-7/8 [25 to 73] outside diameter	1 [25] and over	Unlimited	Unlimited
Pipe 2-7/8 [73] outside diameter and over	2-7/8 [73] and over	Unlimited	Unlimited
Plate	Over 24 [610]	Unlimited	Unlimited

Notes:

1. Qualification on any pipe groove weld also qualifies for fillet welds.
2. For GMAW-S, the maximum weld metal thickness deposited shall not exceed 1.1 times the thickness of weld metal deposited by the GMAW-S process in the qualification test. For base metals 3/8 in [10 mm] thick and greater, side bends are required for GMAW-S.

Annexes

Normative Information

These annexes contain information and requirements that are considered part of the standard.

- Annex A Basis for Establishing a Standard Welding Procedure Specification (SWPS)
- Annex B Illustrations—Welding Position, Test Specimens, and Test Fixtures
- Annex C Filler Metal Grouping
- Annex D Base Metal Grouping
- Annex E Radiographic Examination Procedure

Informative Information

These annexes are not considered part of the standard and are provided for informational purposes.

- Annex F Sample Forms
- Annex G Macroetch Procedure
- Annex H Guidelines for the Preparation of Technical Inquiries
- Annex I Guidelines for Requesting Adoption of New Materials Under the AWS B2.1 Standard

Cross Reference for Renumbered Annexes from the 2005 Code to the 2009 Code

Location in 2005 Code		Location in 2009 Code
Annex I	Basis for Establishing a Standard Welding Procedure Specification (SWPS)	Annex A
Annex II	Illustrations—Welding Position, Test Specimens, and Test Fixtures	Annex B
Annex III	Filler Metal Grouping	Annex C
Annex IV	Base Metal Grouping	Annex D
Annex V	Radiographic Examination Procedure	Annex E
Annex A	Sample Forms	Annex F
Annex B	Macroetch Procedure	Annex G
Annex C	Guidelines for the Preparation of Technical Inquiries	Annex H
—	Guidelines for Requesting Adoption of New Materials Under the AWS B2.1 Standard	Annex I

Annex A (Normative)

Basis for Establishing a Standard Welding Procedure Specification (SWPS)

This annex is part of AWS B2.1/B2.1M:2009-ADD1, *Specification for Welding Procedure and Performance Qualification*, and includes mandatory elements for use with this standard.

The American Welding Society, acting under ANSI rules for consensus standards, publishes AWS Standard Welding Procedure Specifications (SWPSs) which are initiated by the Welding Procedures Committee of the Welding Research Council (WRC). In initiating SWPSs for consideration as AWS standards, the WRC Committee is guided by the successful service experience in welded construction of the combination of base materials, welding process(es), and welding filler metals covered by the scope of each SWPS. An SWPS must meet the rules for qualification of AWS B2.1, *Specification for Welding Procedure and Performance Qualification*, and be approved by the AWS B2 Committee on Procedure and Performance Qualification. All SWPSs are supported by Procedure Qualification Records (PQRs) which meet the rules of AWS B2.1 and which in addition are intended to meet the rules of the major codes which govern the intended applications such as AWS Structural Codes (D1.1, D1.2, D1.3, etc.), AWS Sheet Metal Welding Code (D9.1), and ASME *Boiler and Pressure Vessel Code*, Section IX.

The data to support a Standard Welding Procedure Specification are derived from Procedure Qualification Records (PQRs) generated by the Welding Procedures Committee of the WRC and PQRs received from industry and government agencies. For all committee generated PQRs, the welding, testing, and evaluation are performed under the direct supervision of the WRC Welding Procedures Committee.

To be referenced as a supporting document for an SWPS, a PQR received from an industry or government agency must be qualified and documented in accordance with one of the nationally recognized codes or specifications such as AWS D1.1 through AWS D1.6, AWS D15.1, AWS D14.1 through AWS D14.6, or ASME *Boiler and Pressure Vessel Code*, Section IX. The Welding Procedures Committee of the WRC reviews and validates these PQRs before entering the information contained on them into a data bank.

It is the policy of the AWS B2 Committee that the range of conditions and variables listed for an SWPS be more restrictive than permitted by application of the full range of conditions and variables allowed by the B2.1 document or by other American National Standards (such as AWS D1.1 through AWS D1.6 or ASME *Boiler and Pressure Vessel Code*, Section IX). The purpose of this policy is to restrict the WPS to a high probability of successful application by all users. In judging the extent of such restriction, the Committee is guided by the number and scope of the supporting PQRs, including the specific material, thickness and value for each welding variable used for the development of the PQR, and by known fabrication experience. The minimum number of supporting PQRs required by the Committee is two, but is usually in the range of two to fifty, the specific minimum number being a Committee decision for each WPS. It is the intent of the AWS B2 Committee to have SWPSs only for commonly welded materials and common manual and semi-automatic welding processes.

This page is intentionally blank.

Annex B (Normative)

Illustrations—Weld Position, Test Specimens, and Test Fixtures

This annex is part of AWS B2.1/B2.1M:2009-ADD1, *Specification for Welding Procedure and Performance Qualification*, and includes mandatory elements for use with this standard.

B1. Welding Positions—Illustrated

B1.1 Standard Groove Test Weldment Positions. Figure B.1A illustrates and identifies the positions permitted for Standard Groove Test Weldments. Standard Groove Test Weldments shall be positioned in the applicable position(s) as shown in Figure B.1A, except that an angular deviation of $\pm 15^\circ$ from the specified horizontal and vertical planes and $\pm 5^\circ$ from the specified inclined plane is permitted.

B1.2 Groove Weld Position Changes. Figure B.1B specifies the points at which groove weld position changes occur.

B1.3 Standard Fillet Test Weldment Positions. Figure B.1C illustrates and identifies the positions for Standard Fillet Weld Test Weldments, except that an angular deviation of $\pm 15^\circ$ from the specified horizontal and vertical planes and $\pm 5^\circ$ from the specified inclined plane is permitted. Standard Fillet Test Weldments shall be positioned in the applicable position(s) as illustrated.

B1.4 Fillet Weld Position Changes. Figure B.1D specifies the points at which fillet weld position changes occur.

B1.5 Standard Stud Test Weldment Positions. Figure B.1E illustrates and identifies the positions for Standard Stud Test Weldments. Standard Stud Test Weldments shall be positioned in the applicable position illustrated within the limitations shown in Figure B.1E.

B2. Guided Bend Specimens

B2.1 Preparation of Groove Weld Specimens. Guided bend test specimens shall be prepared by cutting the test plate or pipe to form specimens as illustrated in Figures B.2A, B.2B, and B.2C. The cut surfaces of Figures B.2A and B.2B are designated the specimen sides. The other two surfaces of Figures B.2A and B.2B are designated the face and root surfaces. A side-bend specimen is illustrated in Figure B.2C.

B2.2 Weld reinforcement and backing of face- and root-bend specimens shall be removed flush with the specimen surface. Cut surfaces shall be parallel, may be thermally cut, and shall be machined or ground a minimum of 1/8 in [3 mm] on thermally cut edges, except that M-1 metals may be bent “as-cut” if no objectionable surface roughness exists.

B2.3 Subsize Transverse Face and Root Bends. For pipe of 4 in [102 mm] outside diameter or less, the bend specimen width may be 3/4 in [19 mm], measured around the outside surface. Alternatively, for outside diameters less than 2-7/8 in [73 mm], the width may be that obtained by cutting the pipe into quarter sections.

B2.4 Nonstandard Bend Specimens. For base metal thickness less than 3/8 in [10 mm], the thickness of the specimen may be the thickness of the base metal, except that M-23 and M-35 materials (excluding alloys C95200 and C95400 for which 3/8 in [10 mm] is required) shall be a maximum of 1/8 in [3 mm] thick. For metals less than 1/8 in [3 mm] thick, the specimen thickness shall be the thickness of the base metal.

B3. Tension Specimens

Tension test specimens are illustrated in Figures B.3A, B.3B, B.3C, and B.3D.

B3.1 A single specimen may be used for thicknesses of 1 in [25 mm] or less.

B3.2 For thicknesses over 1 in [25 mm], single or multiple specimens may be used provided that: (1) Collectively, multiple specimens, representing the full thickness of the weld at one location, shall comprise a set. (2) The entire thickness shall be mechanically cut into approximately equal strips. For specimens that are

not turned, specimen thicknesses shall be the maximum size that can be tested in available equipment.

B4. Cladding and Hardfacing Specimens

Bend test and chemical analysis specimens shall be prepared as shown in Figures B.4A and B.4B.

B5. Test Fixtures

Bend and stud test fixtures are shown in Figures B.5A through B.5F.

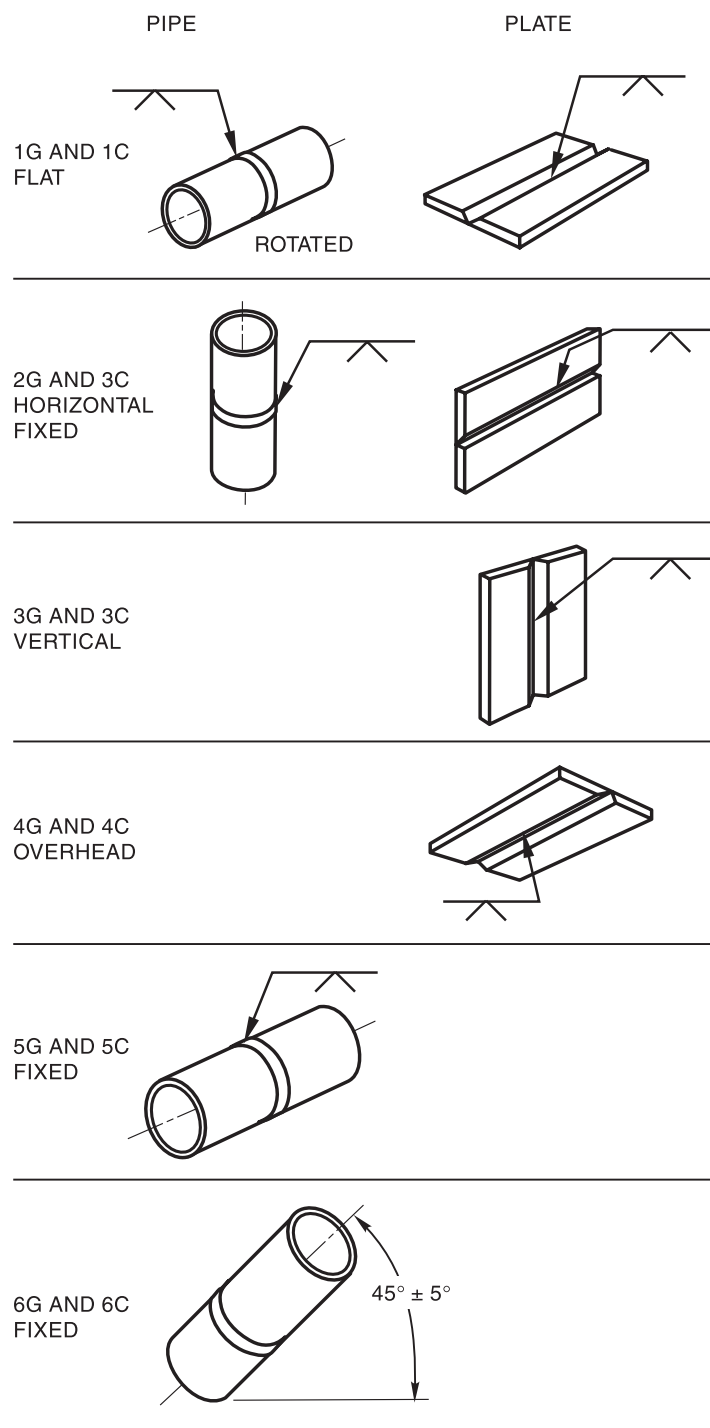
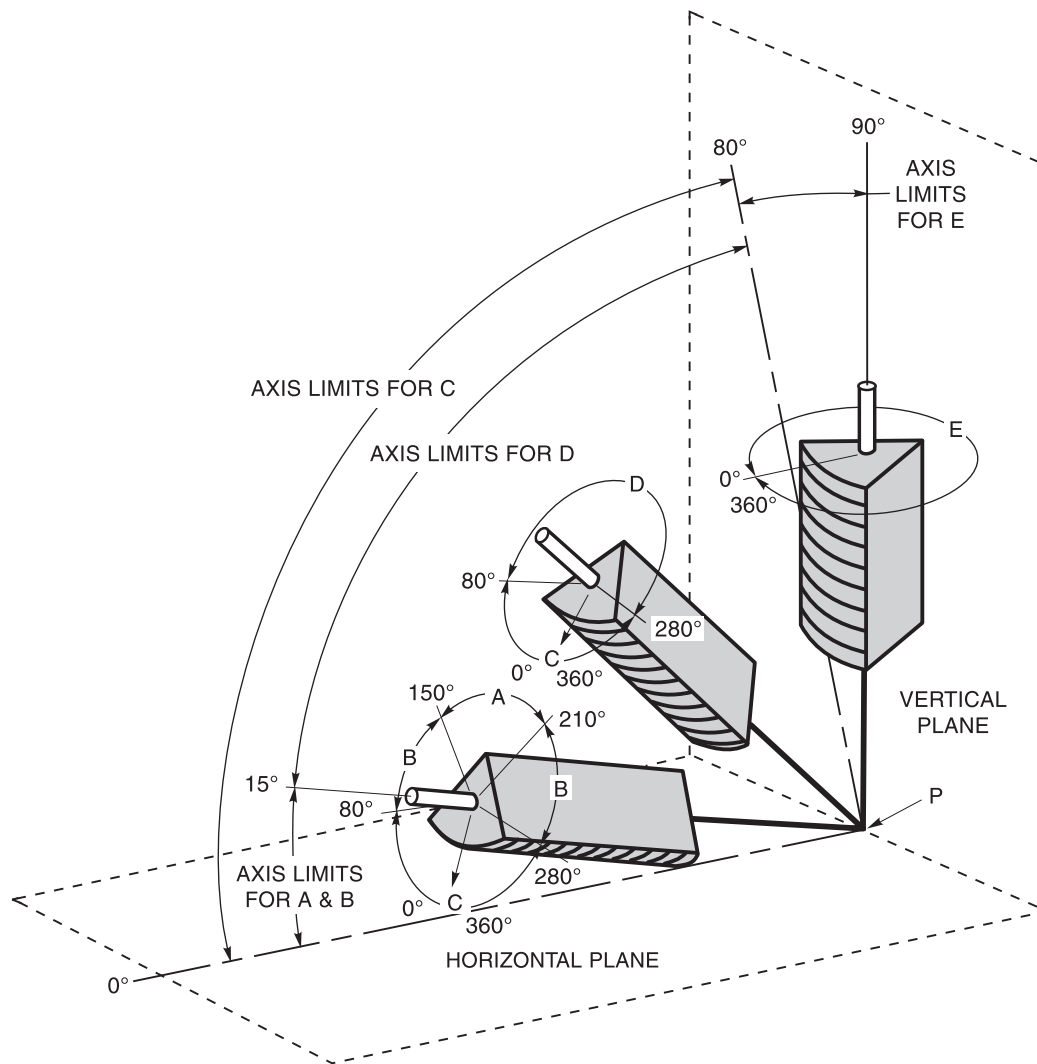


**Figure B.1A—Welding Test Positions—
Groove, Cladding, and Hardfacing Welds**



Tabulation of Positions of Groove Welds			
Position	Diagram Reference	Inclination of Axis	Rotation of Face
Flat	A	0° to 15°	150° to 210°
Horizontal	B	0° to 15°	80° to 150° 210° to 360°
Overhead	C	0° to 80°	0° to 80° 280° to 360°
Vertical	D	15° to 80°	80° to 280° 0° to 360°
	E	80° to 90°	

Notes:

1. The horizontal reference plane is always taken to lie below the weld under construction.
2. The inclination of the weld axis is measured from the horizontal reference plane toward the vertical reference point.
3. The axis of rotation of the weld face is determined by a line perpendicular to the weld face at its center which passes through the weld axis. The reference position (0°) of rotation of the weld face invariably points in the direction opposite to that in which the weld axis angle increases. When looking at point "P," the angle of rotation of the weld face is measured in a clockwise direction from the reference position (0°).

Figure B.1B—Limits of Welding Positions—Groove, Cladding, and Hardfacing Welds

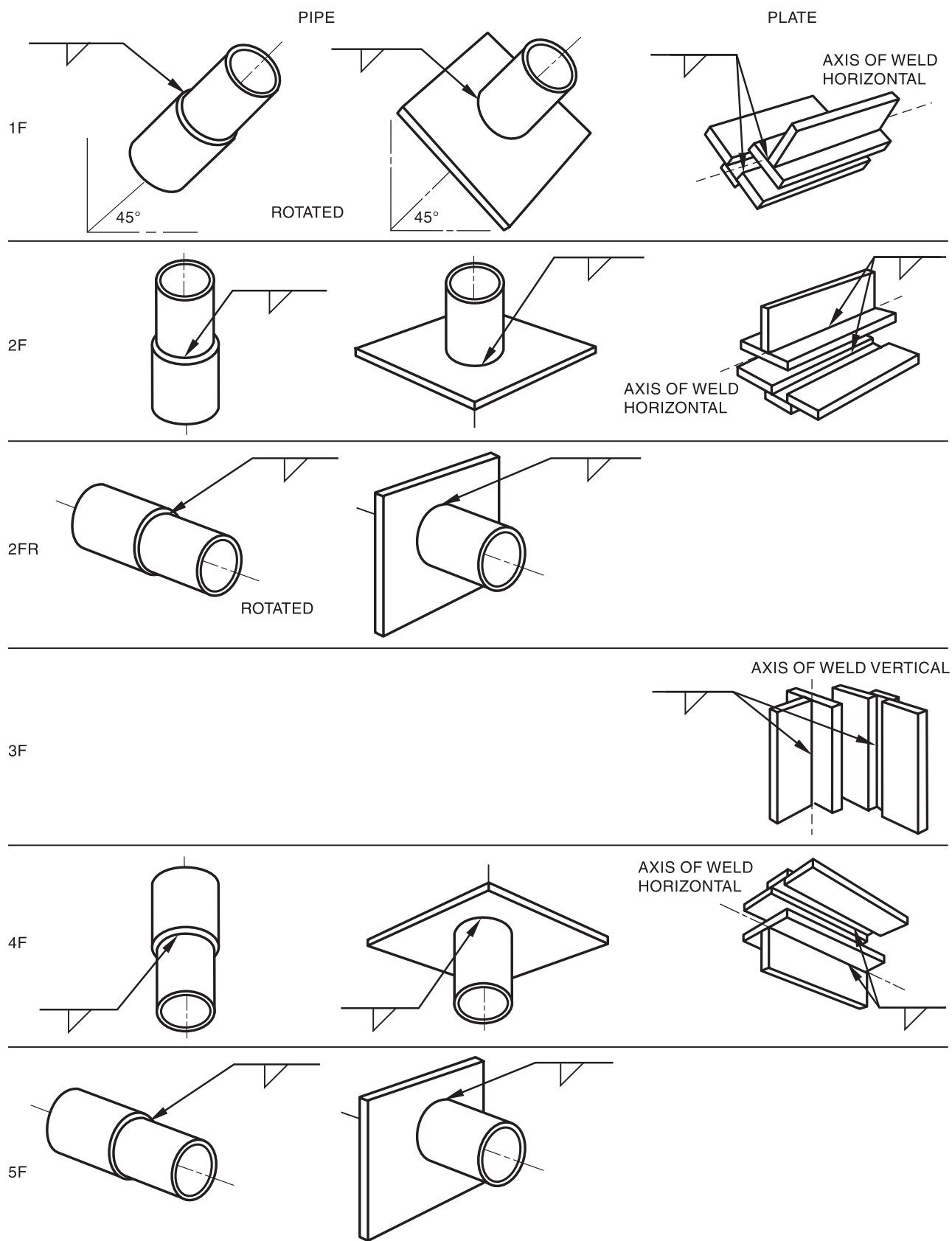
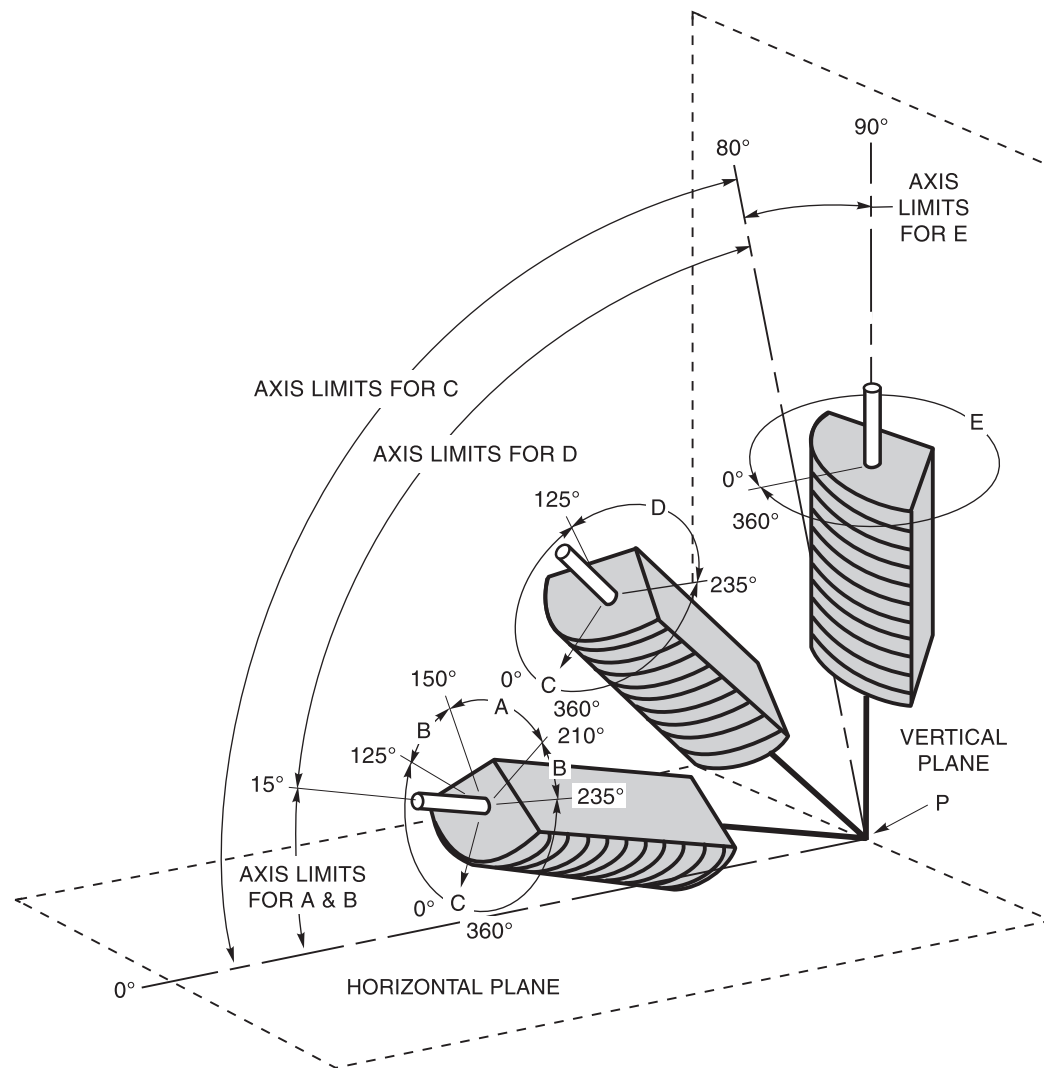


Figure B.1C—Welding Test Positions—Fillet Welds

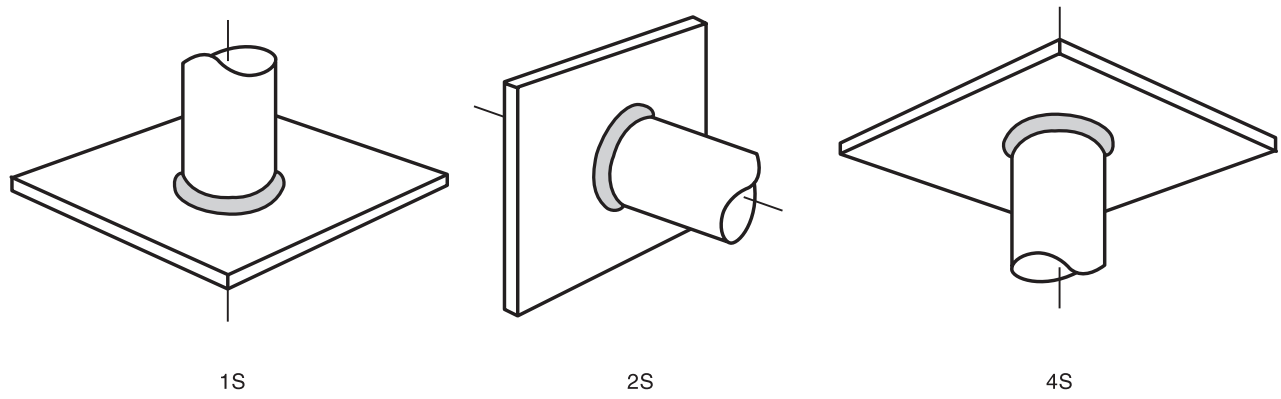


Tabulation of Fillet Welds			
Position	Diagram Reference	Inclination of Axis	Rotation of Face
Flat	A	0° to 15°	150° to 210°
Horizontal	B	0° to 15°	125° to 150° 210° to 235°
Overhead	C	0° to 80°	0° to 125° 235° to 360°
Vertical	D	15° to 80°	125° to 235°
	E	80° to 90°	0° to 360°

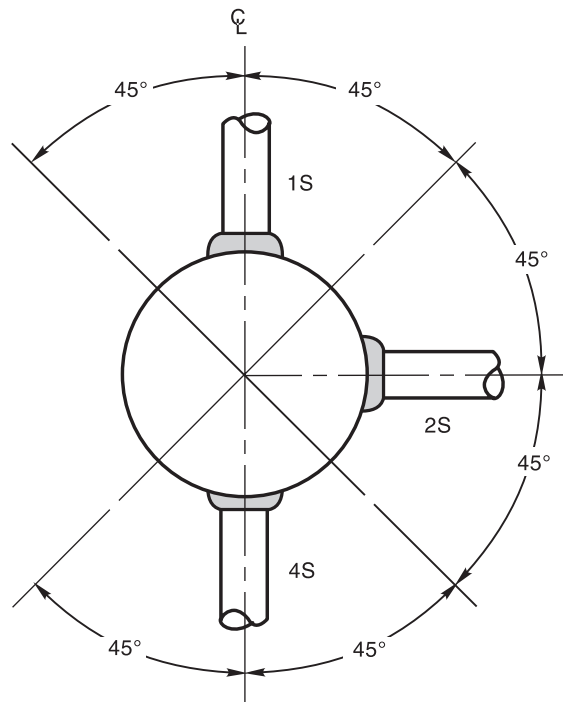
Notes:

1. The horizontal reference plane is always taken to lie below the weld under construction.
2. The inclination of the weld axis is measured from the horizontal reference plane toward the vertical reference point.
3. The axis of rotation of the weld face is determined by a line perpendicular to the weld face at its center which passes through the weld axis. The reference position (0°) of rotation of the weld face invariably points in the direction opposite to that in which the weld axis angle increases. When looking at point "P," the angle of rotation of the weld face is measured in a clockwise direction from the reference position (0°).

Figure B.1D—Limits of Welding Positions—Fillet Welds



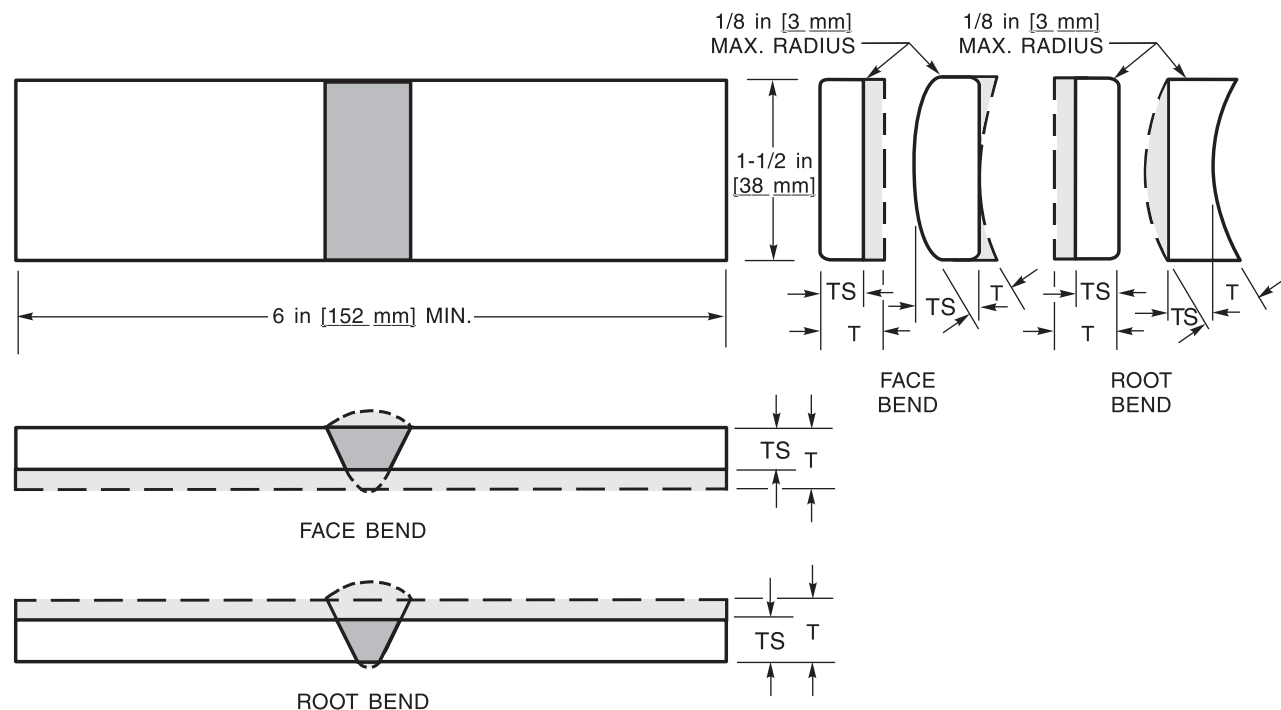
STUD WELDING POSITIONS



LIMITS OF POSITIONS FOR PLATE OR PIPE

STUD WELDING POSITIONS

Figure B.1E—Welding Positions—Stud Welds

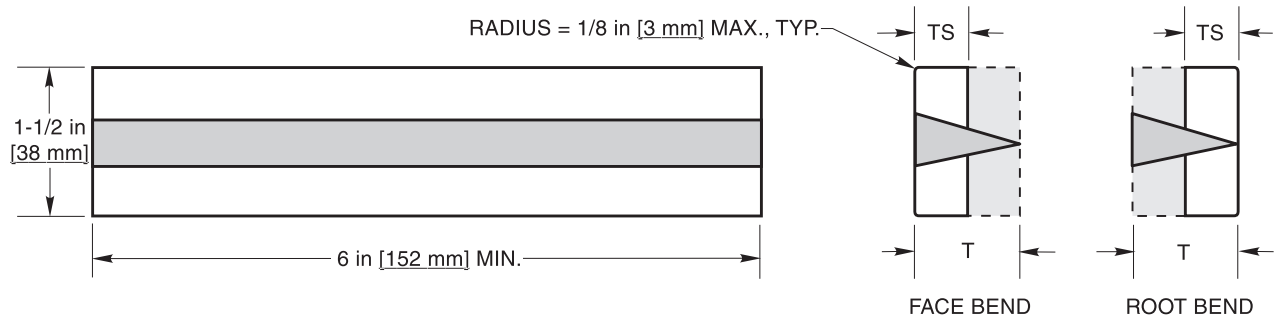


INCHES			MILLIMETERS		
Specimen Thickness (TS)			Specimen Thickness (TS)		
Thickness of Base Materials (T)	All Base Metal Welded with F-23 Filler Metals	All Other Materials	Thickness of Base Materials (T)	All Base Metal Welded with F-23 Filler Metals	All Other Materials
1/16 to 1/8	T	T	1.5 to 3	T	T
1/8 to 3/8	1/8	T	3 to 10	3	T
Over 3/8	1/8	3/8	Over 10	3	10

Notes:

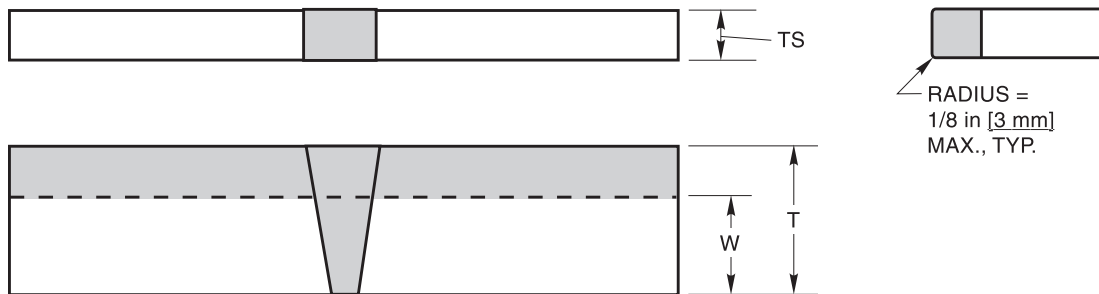
1. Weld reinforcement and backing strip or backing ring, if any, shall be removed flush with the surface of the specimen.
2. If thermal cut, the edges shall be dressed by grinding, except in M-1 materials.
3. For pipe diameters of 2 in through 4 in [51 mm through 102 mm] NPS, the width of the bend specimen may be 3/4 in [19 mm] for pipe diameters of 3/8 in to 2 in [10 mm through 51 mm] NPS, the bend specimen width may be 3/8 in [10 mm], with an alternative (permitted for pipe 1 NPS in and less) of cutting the pipe into quarter sections, in which case the weld reinforcement may be removed and no other preparation of the specimens is required.

Figure B.2A—Transverse Face and Root Bend Specimens



INCHES			MILLIMETERS		
Specimen Thickness (TS)			Specimen Thickness (TS)		
Thickness of Base Materials (T)	All Base Metal Welded with F-23 Filler Metals	All Other Materials	Thickness of Base Materials (T)	All Base Metal Welded with F-23 Filler Metals	All Other Materials
1/16 to 1/8	T	T	1.5 to 3	T	T
1/8 to 3/8	1/8	T	3 to 10	3	T
Over 3/8	1/8	3/8	Over 10	3	10

Figure B.2B—Longitudinal Face and Root Bend Specimens

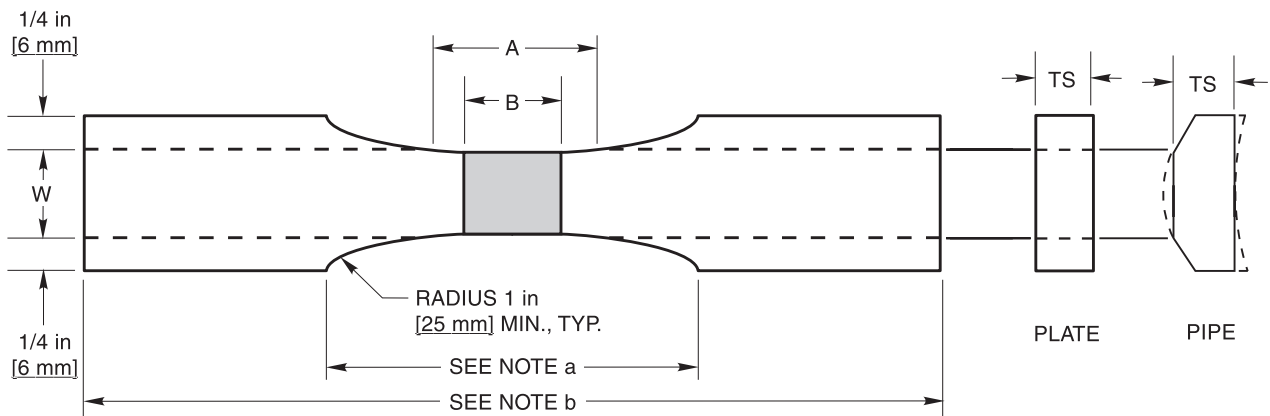


INCHES				MILLIMETERS			
Specimen Thickness (TS)				Specimen Thickness (TS)			
Weld Thickness	All Base Metal Welded with F-23 Filler Metals	All Other M Numbers	Width of Specimen (W)	Weld Thickness	All Base Metal Welded with F-23 Filler Metals	All Other M Numbers	Width of Specimen (W)
3/8 to 1-1/2	1/8	3/8	T	10 to 38	3	10	T
Over 1-1/2	1/8	3/8	See Note 3	Over 38	3	10	See Note 3

Notes:

1. Weld reinforcement and backing strip or backing ring, if any, shall be removed flush with the surface of the specimen. If a recessed ring is used, this surface of the specimen may be machined to a depth not exceeding the depth of the recess to remove the ring, except that in such cases the thickness of the finished specimen shall be that specified above.
2. If thermal cut, the edges shall be dressed by grinding, except in M-1 materials.
3. When a side bend specimen thickness "T" exceeds 1-1/2 in [38 mm], it may be bent at full width, or it may be cut into multiple test specimens of approximately equal dimensions provided the specimens are not less than 3/4 in [19 mm] wide.

Figure B.2C—Transverse Side Bend Specimens



INCHES				MILLIMETERS			
Test Weldment				Test Weldment			
Dimensions	Plate	Pipe Outside Diameter		Dimensions	Plate	Pipe Outside Diameter	
		<3	>3			<76	>76
B	← See Note c →			B	← See Note c →		
A	← See Note d →			A	← See Note d →		
W	3/4	1/2	3/4	W	19	13	19
TS	TS ^{e, f}	See Note e		TS	TS ^{e, f}	See Note e	

^a This section shall be cut by machining or grinding.

^b The specimen length shall be as required by the tension testing equipment.

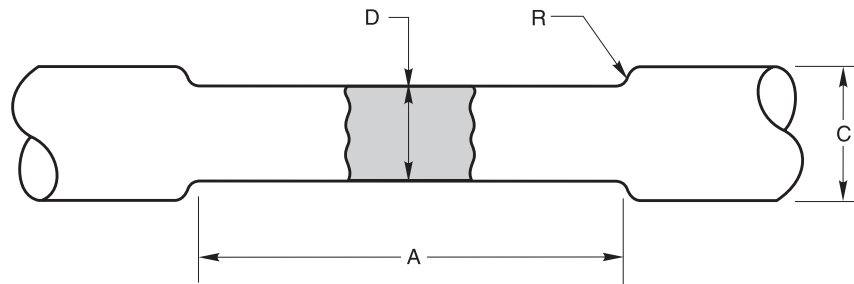
^c B shall be equal to the greater dimension of the weld metal in the direction of the specimen longitudinal axis.

^d The length of the reduced section A shall be equal to B, plus 1/2 in [13 mm]; with a minimum of 2-1/4 in [57 mm]. The ends shall not differ in width from the ends to the center, but the width at either end shall not be more than 0.015 in [0.40 mm] greater than the width at the center. The weld shall be in the center of the reduced section.

^e The amount removed shall be the minimum needed to obtain plane parallel surfaces across the width of the reduced section.

^f For base metal thicknesses greater than 1 in [25 mm], multiple tension specimens may be substituted for the single tension specimen from each blank. If multiple specimens are used, one complete set shall be made for each required test. The specimen blank shall be cut into strips of approximately equal thickness.

Figure B.3A—Reduced Section Tension Specimen—Rectangular



INCHES					MILLIMETERS				
Standard Specimen Dimensions ^{a, c}					Standard Specimen Dimensions ^{a, c}				
Dimensions	0.505	0.353	0.252	0.188	Dimensions	13	9	6	5
A = Length of Reduced Section ^{b, d}	← See Note d →				A = Length of Reduced Section ^{b, d}	← See Note d →			
D = Diameter	0.500 ± 0.010	0.350 ± 0.007	0.250 ± 0.005	0.188 ± 0.003	D = Diameter	13 ± 0.25	9 ± 0.18	6 ± 0.13	5 ± 0.08
R = Radius, min.	3/8	1/4	3/16	1/8	R = Radius, min.	10	6	5	3
C = Diameter	3/4	1/2	3/8	1/4	C = Diameter	19	13	10	6

^a The standard specimen selected shall be based upon the maximum diameter specimen that can be cut from the specimen blank.

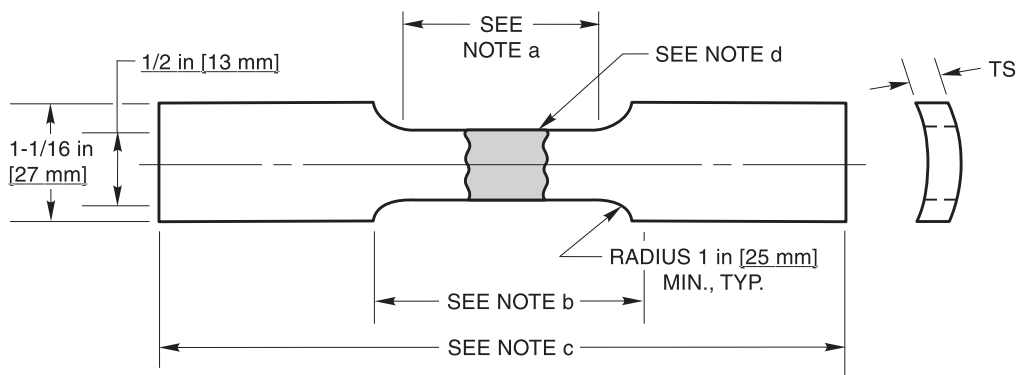
^b The weld shall be in the center of the reduced section.

^c Where only a single specimen from a blank is required, the specimen longitudinal axis shall be midway between the base metal surfaces.

^d The length of the reduced section shall be not less than the width of the weld metal plus 2D. It may have a gradual taper from the ends toward the center, with the ends not more than 1% greater in diameter than the center, which shall be the dimension D. The ends may be of any length and shape as required by the testing machine.

Note: For base metal thicknesses over 1 in [25 mm], multiple specimens are required and one complete set shall be made for each required test. The specimen blank shall be cut into strips of approximately equal thickness with their center lines no more than 1 in [25 mm] apart. The centerline of the surface shall be within 5/8 in [16 mm] of that surface.

Figure B.3B—Reduced Section Tension Specimen—Round



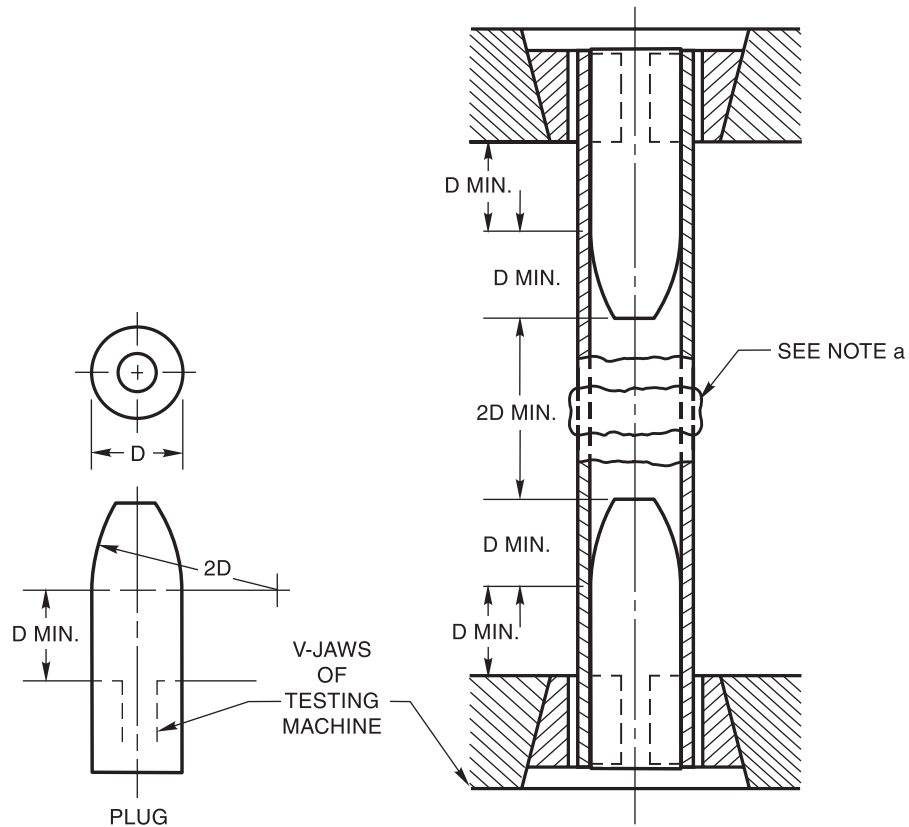
^a The length of the reduced section shall be equal to the greater dimension of the weld metal in the direction of the specimen longitudinal axis, plus 2T. The sides shall be approximately parallel. The weld shall be in the center of the reduced section.

^b The reduced section shall be cut by machining or grinding.

^c The specimen length shall be as required by the tension testing equipment.

^d The weld reinforcement shall be removed such that the weld metal thickness equals that of the base metal thickness.

Figure B.3C—Alternate Tension Specimen for Pipe 3 in [76 mm] O.D. or Less

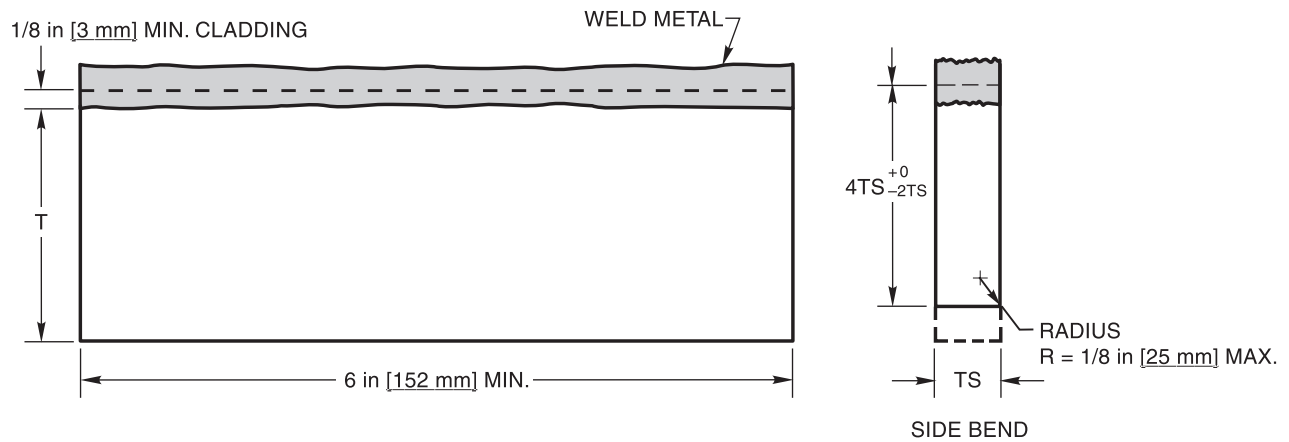


^a The weld reinforcement shall be removed such that the weld metal thickness equals that of the base metal thickness.

Notes:

1. The length of the reduced section shall be equal to the greater dimension of the weld metal in the direction of the specimen longitudinal axis, plus 2 times the thickness of the test weldment. The sides shall be approximately parallel. The weld shall be in the center of the reduced section.
2. This section shall be cut by machining and grinding.
3. The specimen length shall be as required by the tension testing equipment.

Figure B.3D—Alternate Tension Specimen for Pipe 2 in [51 mm] O.D. or Less



INCHES		MILLIMETERS	
T^a	TS^b	T^a	TS^b
1/8 to 3/8	T	3 to 10	T
Over 3/8	3/8	Over 10	10

^a T = the thickness of base metal.

^b TS = thickness of test specimen.

Figure B.4A—Weld Cladding Side Bend Specimens

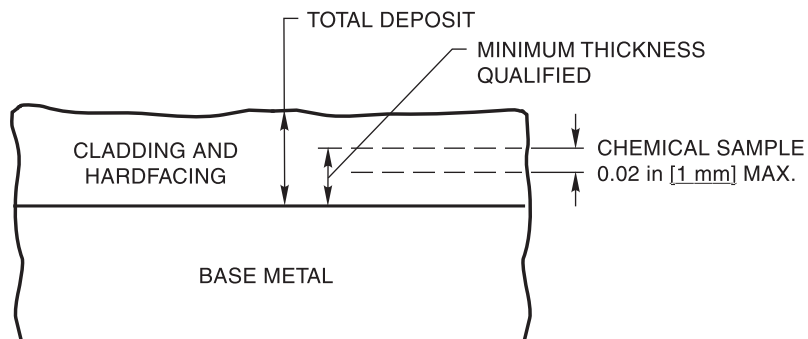
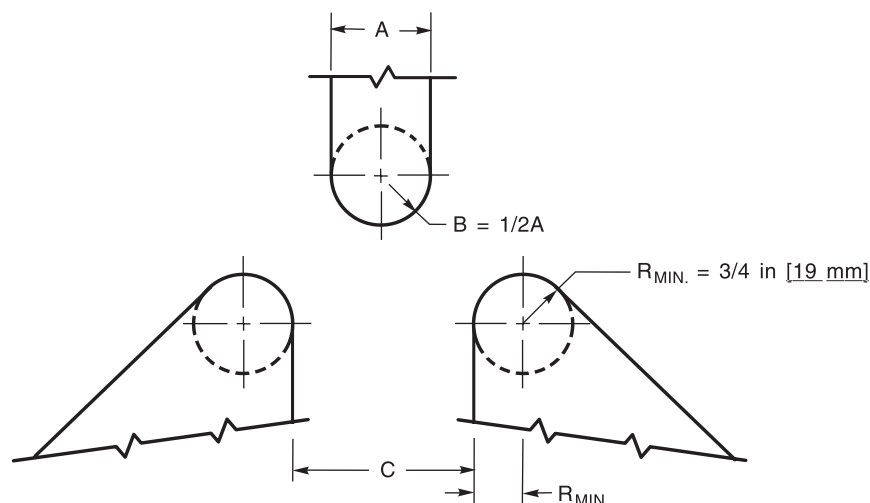


Figure B.4B—Weld Cladding and Hardfacing Chemical Analysis Specimens



INCHES				MILLIMETERS			
Base Metal ^b	TS ^a	A	C	Base Metal ^b	TS ^a	A	C
M-23 (as welded)				M-23 (as welded)			
M-35 except B148 and B271	<1/8	(16-1/2)TS	(18-1/2)TS + 1/16	M-35 except B148 and B271	<3	(16-1/2)TS	(18-1/2)TS + 1/16
All base metal welded with F-23 filler metals	1/8	2-1/16	2-3/8	All base metals welded with F-23 consumables	3	<u>50</u>	<u>57</u>
M-11				M-11			
M-23 (annealed)	<3/8	(6-2/3)TS	(8-2/3)TS + 1/8	M-23 (annealed)	<10	(6-2/3)TS	(8-2/3)TS + 3
M-25	3/8	2-1/2	3-3/8	M-25	10	<u>67</u>	<u>90</u>
M-35, B148, and B271				M-35, B148, and B271			
M-24 (annealed)	≤3/8	8TS	10TS + 1/8	M-24 (annealed)	≤10	8TS	10TS + 3
M-27, M-61, and M-62				M-27, M-61, and M-62			
M-52 and M-53	≤3/8	10TS	12TS + 1/8	M-52 and M-53	≤10	10TS	12TS + 3
M-54	≤3/8	14TS	16TS + 1/8	M-54	≤10	14TS	16TS + 3
All other M-Number metals	<3/8	4TS	6TS + 1/8	All other M-Number metals	<10	4TS	6TS + 3
	3/8	1-1/2	2-3/8		10	<u>40</u>	<u>63</u>

^a TS = Specimen thickness.

^b For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing (see also Figures B.5B and B.5C).

Notes:

1. To calculate the minimum bend diameter for any thickness specimen, use the following formula: $A = (100 \text{ TS}/E) - \text{TS}$

Where A = bend diameter, E = minimum tensile elongation, and TS = test specimen thickness.

Example: For a 3/8 in [10 mm] thick 4130 welded bend specimen with 14% elongation:

$$A = (100 \times 0.375/14) - 0.375 = 37.5/14 - 0.375 = 2.679 - 0.375 = 2.30 \text{ in [58 mm]}.$$

Use A = 2.5 in [64 mm]

To calculate the specimen thickness for any bend diameter, use the following:

$$\text{TS} = (A \times E)/(100 - E)$$

Where TS = test specimen thickness, A = bend test diameter, and E = minimum tensile elongation.

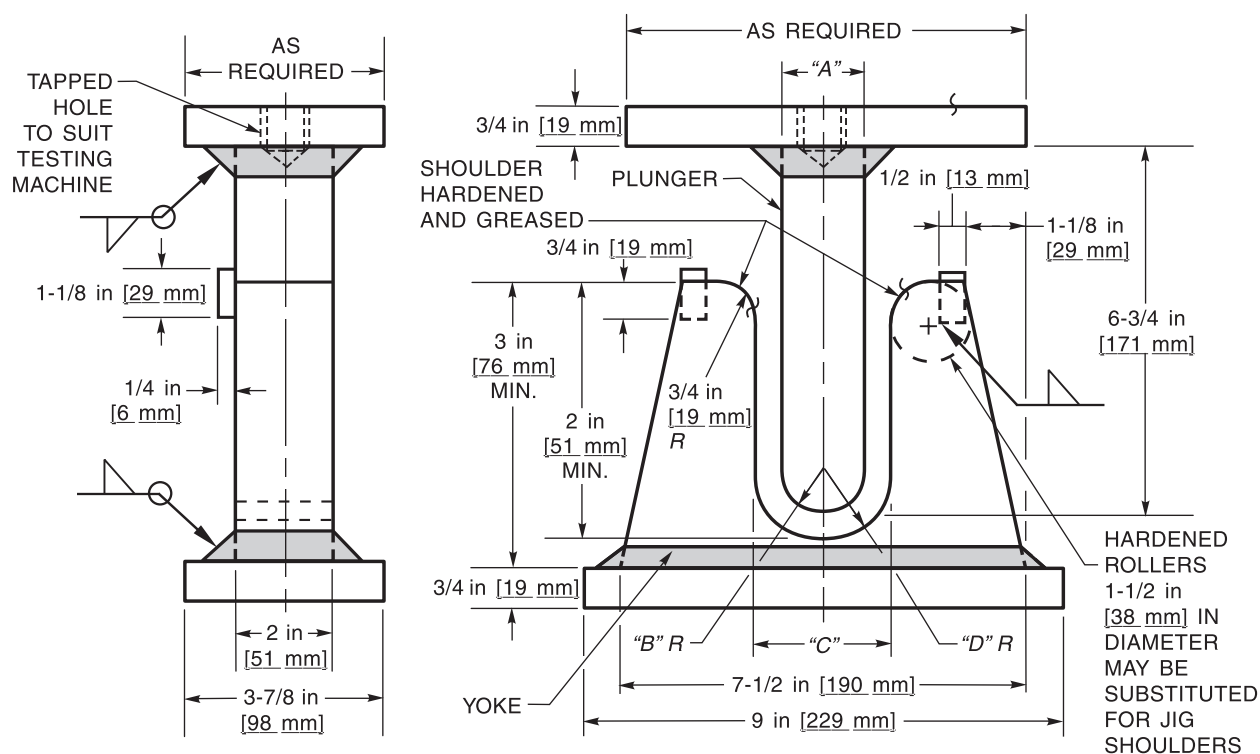
Example: For a standard 1.5 in [38 mm] bend diameter on a test specimen with 14% elongation:

$$\text{TS} = (1.5 \times 14)/(100 - 14) = 21/86 = 0.244$$

Use TS = 0.225 in [5.715 mm]

2. The shoulders of the test figure shall either be hardened rollers free to rotate or hardened and greased fixed shoulder.

Figure B.5A—Guided Bend Fixture—Bottom Ejecting Type



INCHES				MILLIMETERS			
Base Metal ^b	TS ^a	A	C	Base Metal ^b	TS ^a	A	C
M-23 (as welded)				M-23 (as welded)			
M-35 except B148 and B271	<1/8	(16-1/2)TS	(18-1/2)TS + 1/16	M-35 except B148 and B271	<3	(16-1/2)TS	(18-1/2)TS + 1/16
All base metal welded with F-23 filler metals	1/8	2-1/16	2-3/8	All base metals welded with F-23 consumables	3	<u>50</u>	<u>57</u>
M-11				M-11			
M-23 (annealed)	<3/8	(6-2/3)TS	(8-2/3)TS + 1/8	M-23 (annealed)	<10	(6-2/3)TS	(8-2/3)TS + 3
M-25	3/8	2-1/2	3-3/8	M-25	10	<u>67</u>	<u>90</u>
M-35, B148, and B271				M-35, B148, and B271			
M-24 (annealed)				M-24 (annealed)			
M-27, M-61, and M-62	≤3/8	8TS	10TS + 1/8	M-27, M-61, and M-62	≤10	8TS	10TS + 3
M-52 and M-53	≤3/8	10TS	12TS + 1/8	M-52 and M-53	≤10	10TS	12TS + 3
M-54	≤3/8	14TS	16TS + 1/8	M-54	≤10	14TS	16TS + 3
All other M-Number metals	<3/8 3/8	4TS 1-1/2	6TS + 1/8 2-3/8	All other M-Number metals	<10 10	4TS <u>40</u>	6TS + 3 <u>63</u>

^aTS = Specimen thickness.

^b For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing (see also Figures B.5A and B.5C).

Notes:

1. To calculate the minimum bend diameter for any thickness specimen, use the following formula: $A = (100 TS/E) - TS$

Where A = bend diameter, E = minimum tensile elongation, and TS = test specimen thickness.

Example: For a 3/8 in [10 mm] thick 4130 welded bend specimen with 14% elongation:

$$A = (100 \times 0.375/14) - 0.375 = 37.5/14 - 0.375 = 2.679 - 0.375 = 2.30 \text{ in [58 mm]}.$$

Use $A = 2.5$ in [64 mm]

To calculate the specimen thickness for any bend diameter, use the following:

$$TS = (A \times E)/(100 - E)$$

Where TS = test specimen thickness, A = bend test diameter, and E = minimum tensile elongation.

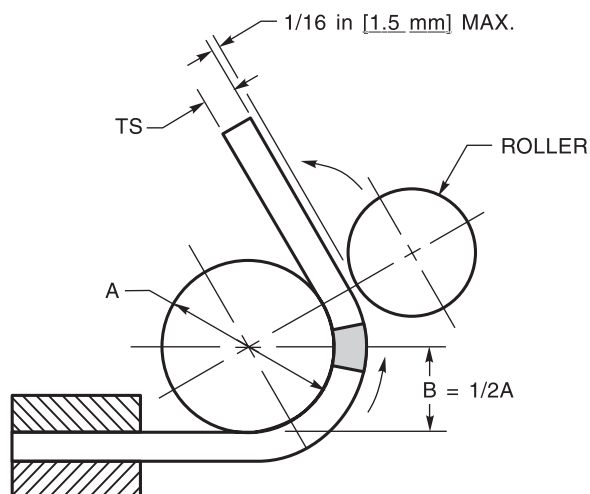
Example: For a standard 1.5 in [38 mm] bend diameter on a test specimen with 14% elongation:

$$TS = (1.5 \times 14) / (100 - 14) = 21 / 86 = 0.244$$

Use TS = 0.225 in [5.715 mm]

2. The shoulders of the test figure shall either be hardened rollers free to rotate or hardened and greased fixed shoulder.

Figure B.5B—Guided Bend Fixture—Bottom Type



INCHES			MILLIMETERS		
Base Metal ^b	TS ^a	A	Base Metal ^b	TS ^a	A
M-23 (as welded)			M-23 (as welded)		
M-35 except B148 and B271	<1/8	(16-1/2)TS	M-35 except B148 and B271	<3	(16-1/2)TS
All base metal welded with F-23 filler metals	1/8	2-1/16	All base metals welded with F-23 consumables	3	<u>50</u>
M-11			M-11		
M-23 (annealed)	<3/8	(6-2/3)TS	M-23 (annealed)	<10	(6-2/3)TS
M-25	3/8	2-1/2	M-25	10	<u>67</u>
M-35, B148, and B271			M-35, B148, and B271		
M-24 (annealed)	≤3/8	8TS	M-24 (annealed)	≤10	8TS
M-27, M-61, and M-62			M-27, M-61, and M-62		
M-52 and M-53	≤3/8	10TS	M-52 and M-53	≤10	10TS
M-54	≤3/8	14TS	M-54	≤10	14TS
All other M-Number metals	<3/8	4TS	All other M-Number metals	<10	4TS
	3/8	1-1/2		10	<u>40</u>

^a TS = Specimen thickness.

^b For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing (see also Figures B.5A and B.5B).

Notes:

1. To calculate the minimum bend diameter for any thickness specimen, use the following formula: $A = (100 TS/E) - TS$

Where A = bend diameter, E = minimum tensile elongation, and TS = test specimen thickness.

Example: For a 3/8 in [10 mm] thick 4130 welded bend specimen with 14% elongation:

$$A = (100 \times 0.375/14) - 0.375 = 37.5/14 - 0.375 = 2.679 - 0.375 = 2.30 \text{ in } [58 \text{ mm}].$$

Use A = 2.5 in [64 mm]

To calculate the specimen thickness for any bend diameter, use the following:

$$TS = (A \times E)/(100 - E)$$

Where TS = test specimen thickness, A = bend test diameter, and E = minimum tensile elongation.

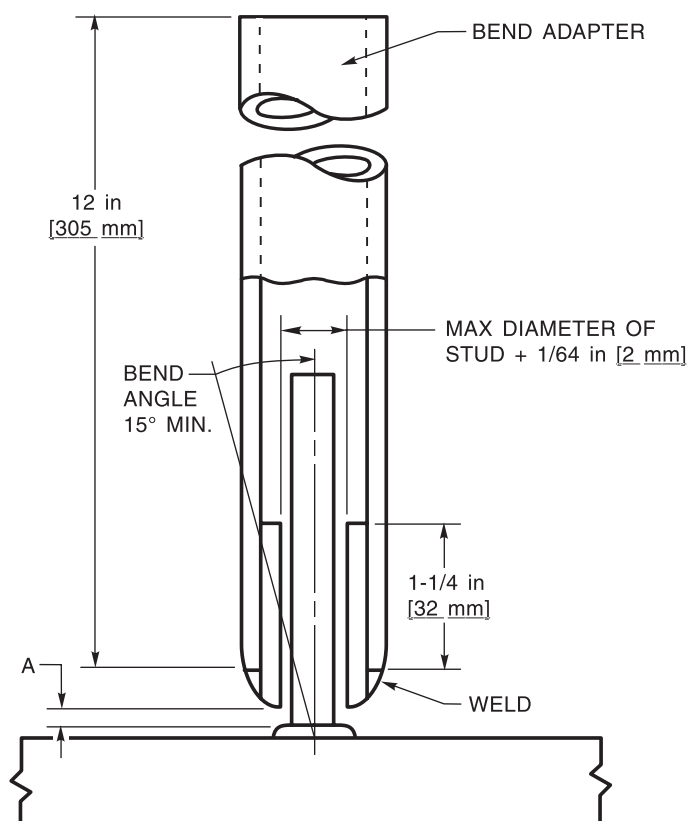
Example: For a standard 1.5 in [38 mm] bend diameter on a test specimen with 14% elongation:

$$TS = (1.5 \times 14)/(100 - 14) = 21/86 = 0.244$$

Use TS = 0.225 in [5.715 mm]

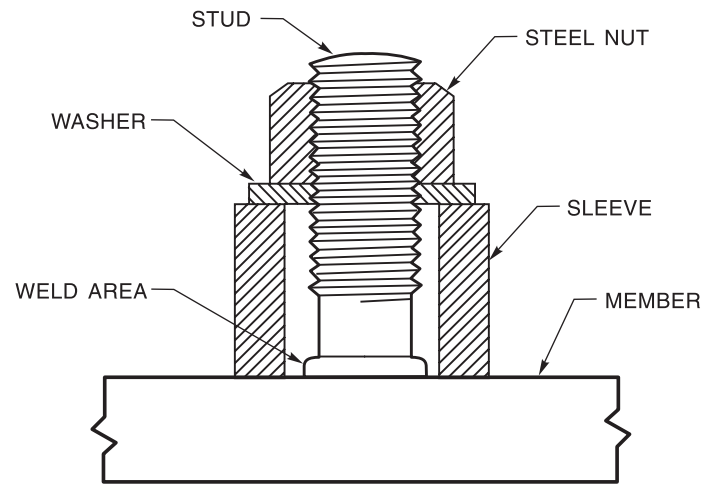
2. The shoulders of the test figure shall either be hardened rollers free to rotate or hardened and greased fixed shoulder.

Figure B.5C—Guided Bend Fixture—Wrap-Around



INCHES									
For Stud Diameter	1/8	3/16	1/4	3/8	1/2	5/8	3/4	7/8	1
Use Adapter Gap "A"	1/8	1/8	3/16	7/32	5/16	11/32	15/32	15/32	19/32
MILLIMETERS									
For Stud Diameter	3	5	6	10	13	16	19	22	25
Use Adapter Gap "A"	3	3	5	6	8	9	12	12	15

Figure B.5D—Stud Weld Bend Test Fixture



Note: Dimensions are appropriate to the size of the stud. Threads of the stud shall be clean and free of lubricant other than residual cutting oil.

Figure B.5E—Stud Weld Torque Test Fixture

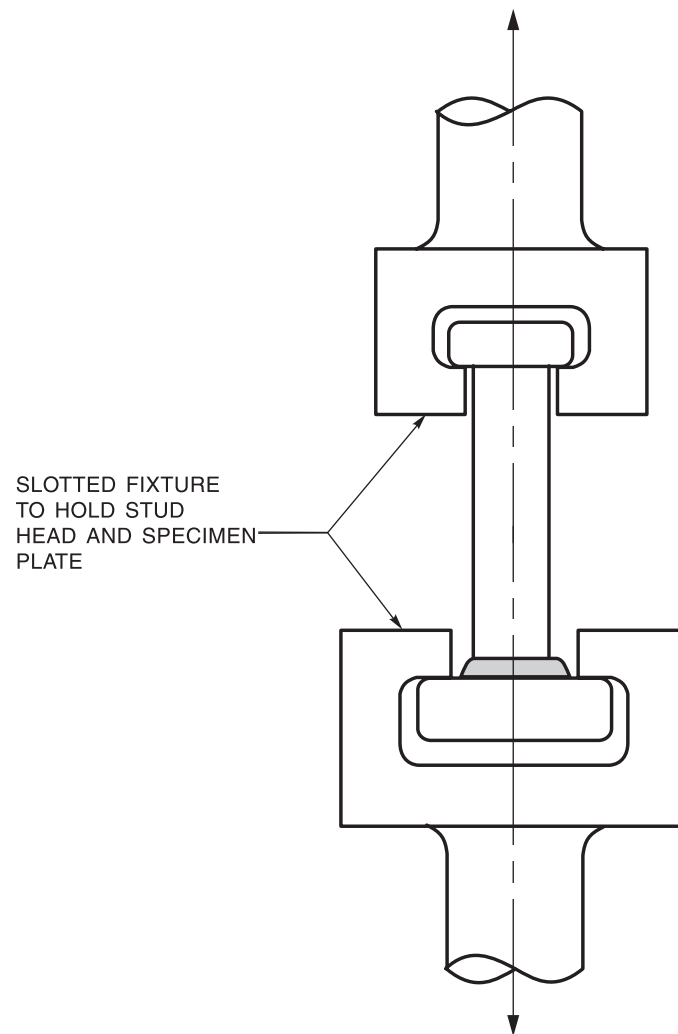


Figure B.5F—Stud Weld Tension Test Fixture

This page is intentionally blank.

Annex C (Normative)

Filler Metal Grouping

This annex is part of AWS B2.1/B2.1M:2009-ADD1, *Specification for Welding Procedure and Performance Qualification*, and includes mandatory elements for use with this standard.

C1. F-Numbers

The F-Number grouping of electrodes and welding rods given in Table C.1 is based primarily on their usability characteristics, which fundamentally determine the ability to make satisfactory welds with a given filler metal and welding process. This grouping is made to reduce the number of welding procedure and performance qualifications, where this can logically be done. The grouping does not imply that filler metals within a group may be indiscriminately substituted for the filler metal that was used in the qualification test weldment without consideration of the compatibility of the base and filler metals from the standpoint of metallurgical properties, postweld heat treatment, design, service requirements, and me-

chanical properties. The groupings in Table C.1 follow essentially the F-Number designations established by the ASME *Boiler and Pressure Vessel Code*, Section IX. Filler metals not listed in Table C.1, but assigned an F-Number by ASME Section IX, are considered as listed filler metals.

C2. A-Numbers

The classification of ferrous weld metal for procedure qualification is given in Table C.2. Those A-Numbers follow essentially the A-Number designations established by the ASME *Boiler and Pressure Vessel Code*, Section IX.

Table C.1
Grouping of Welding Electrodes and Rods for Qualification

F-No.	AWS Specification	AWS Classification
Steel		
1	A5.1	EXX20, EXX22, EXX24, EXX27, EXX28
1	A5.4	EXXX(X)-26
1	A5.5	EXX20-XX, EXX27-XX
2	A5.1	EXX12, EXX13, EXX14, EXX19
2	A5.5	E(X)XX13-XX
3	A5.1	EXX10, EXX11
3	A5.5	E(X)XX10-XX, E(X)XX11-XX
4	A5.1	EXX15, EXX16, EXX18, EXX18M, EXX48
4	A5.4 other than austenitic and duplex	EXXX(X)-15, EXXX(X)-16, EXXX(X)-17
4	A5.5	E(X)XX15-XX, E(X)XX16-XX, E(X)XX18-XX, E(X)XX18M, E(X)XX18M1, E(X)XX45-P2
5	A5.4 austenitic and duplex	EXXX(X)-15, EXXX(X)-16, EXXX(X)-17
6	A5.2	RX
6	A5.9	<u>All Classifications</u>
6	A5.17	<u>All Classifications</u>
6	A5.18	<u>All Classifications</u>
6	A5.20	<u>All Classifications</u>
6	A5.22	<u>All Classifications</u>
6	A5.23	<u>All Classifications</u>
6	A5.25	<u>All Classifications</u>
6	A5.26	<u>All Classifications</u>
6	A5.28	<u>All Classifications</u>
6	A5.29	<u>All Classifications</u>
6	A5.30	<u>INMs-X, IN5XX, IN3XX(X)</u>
Aluminum and Aluminum Alloys		
21	A5.3	E1100, E3003
21	A5.10	ER1100, R1100, ER1188, R1188
22	A5.10	ER5183, R5183, ER5356, R5356, ER5554, R5554, ER5556, R5556, ER5654, R5654
23	A5.3	E4043
23	A5.10	ER4009, R4009, ER4010, R4011, R4010, ER4043, R4043, ER4047, R4047, ER4145, R4145, ER4643, R4643
24	A5.10	R206.0, R-C355.0, R-A356.0, R357.0, R-A357.0
25	A5.10	ER2319, R2319
Copper and Copper Alloys		
31	A5.6	ECu
31	A5.7	ERCu
32	A5.6	ECuSi
32	A5.7	ERCuSi-A
33	A5.6	ECuSn-A, ECuSn-C
33	A5.7	ERCuSn-A
34	A5.6	ECuNi

(Continued)

Table C.1 (Continued)
Grouping of Welding Electrodes and Rods for Qualification

F-No.	AWS Specification	AWS Classification
34	A5.7	ERCuNi
34	A5.30	IN67
35	A5.8	RBCuZn-A, RBCuZn-B, RBCuZn-C, RBCuZn-D
36	A5.6	ECuAl-A2, ECuAl-B
36	A5.7	ERCuAl-A1, ERCuAl-A3, ERCuAl-A2
37	A5.6	ECuNiAl, ECuMnNiAl
37	A5.7	ERCuNiAl, ErCuMnNiAl
Nickel and Nickel Alloys		
41	A5.11	ENi-1
41	A5.14	ERNi-1
41	A5.30	IN61
42	A5.11	ENiCu-7
42	A5.14	ERNiCu-7, ERNiCu-8
42	A5.30	IN60
43	A5.11	ENiCrFe-1, 2, 3, 4, 7, 9, 10, and <u>12</u> ; ENiCrMo-2, 3, <u>4</u> , <u>5</u> , <u>6</u> , <u>7</u> , <u>10</u> , <u>12</u> , <u>13</u> , <u>14</u> , <u>17</u> , <u>18</u> , and <u>19</u> ; ENiCrCoMo-1; ENiCr-4; ENiCrWMo-1
43	A5.14	ERNiCr-3, 4, and 6; ERNiCrFe-5, 6, 7, <u>7A</u> , 8, 11, and <u>12</u> ; ERNiCrCoMo-1; ERNiCrMo-2, 3, <u>4</u> , <u>7</u> , <u>10</u> , <u>13</u> , <u>14</u> , <u>16</u> , <u>17</u> , <u>18</u> , <u>19</u> , <u>20</u> , and <u>21</u> ; <u>ERNiCrFeAl-1</u> ; <u>ERNiCrWMo-1</u>
43	A5.30	IN6A, IN62, IN82, <u>IN52</u>
44	A5.11	ENiMo-1, 3, 7, 8, 9, 10, and <u>11</u>
44	A5.14	ERNiMo-1, 2, 3, 7, 8, 9, 10, <u>11</u> , and <u>12</u>
45	A5.11	ENiCrMo-1, 9, and 11
45	A5.14	ERNiCrMo-1, 8, 9, and 11; ERNiFeCr-1
<u>46</u>	<u>A5.11</u>	<u>ENiCrFeSi-1</u>
<u>46</u>	<u>A5.14</u>	<u>ERNiCrFeSi-1</u> , <u>ERNiCoCrSi-1</u>
Titanium and Titanium Alloys		
51	A5.16	ERTi-1, 2, 3, <u>7</u> , <u>11</u> , <u>13</u> , <u>14</u> , <u>15A</u> , <u>16</u> , <u>17</u> , <u>26</u> , <u>27</u> , <u>30</u> , <u>31</u> , <u>33</u> , and <u>34</u>
52	A5.16	ERTi-4
53	A5.16	ERTi-9, ERTi-9ELI, <u>ERTi-18</u> , <u>ERTi-28</u>
54	A5.16	ERTi-12
55	A5.16	ERTi-5, <u>23</u> , <u>29</u> , <u>24</u> , and <u>25</u>
<u>56</u>	<u>A5.16</u>	<u>ERTi-32</u>
Zirconium and Zirconium Alloys		
62	A5.24	ERZr2, ERZr3, ERZr4
Hardfacing Weld Metal Overlay		
71	A5.13	EXXX-X
<u>72</u>	<u>A5.21</u>	<u>RXXX-X</u> , <u>ERXX-X</u> , <u>ERCXX-X</u>
Magnesium Alloys		
91	A5.19	ER AZ61A, ER AZ92A, ER EZ33A, ER AZ101A, R AZ61A, R AZ92A, R AZ101A, R EZ33A

Table C.2
Classification of Ferrous Weld Metal for Procedure Qualification

A-No.	Type of Weld Metal	Chemical Composition, wt %					
		C	Cr	Mo	Ni	Mn	Si
1	Low-carbon	0.20	—	—	—	1.60	1.00
2	Carbon-Molybdenum	0.15	0.50	0.40–0.65	—	1.60	1.00
3	Chromium	0.15	0.40–2.0	0.40–0.65	—	<u>1.60</u>	1.00
4	Chromium	0.15	1.75–6.0	0.40–1.50	—	1.60	2.00
5	Chromium	0.15	6.00–10.5	0.40–1.50	—	1.20	2.00
6	Chromium, martensitic	0.15	11.00–15.0	0.70	—	2.00	1.00
7	Chromium, ferritic	0.15	11.00–30.0	1.00	—	1.00	3.00
8	Chromium-Nickel	0.15	14.50–30.0	4.00	7.50–15.0	2.50	1.00
9	Chromium-Nickel	0.35	19.0–30.0	6.00	15.0– <u>37.0</u>	2.50	1.00
10	Nickel	0.15	—	0.55	0.80–4.0	1.70	1.00
11	Manganese-Molybdenum	0.17	—	0.25–0.75	0.85	1.25–2.25	1.00
12	Nickel-Chromium-Molybdenum	0.15	1.50	0.25–0.80	1.25–2.80	0.75–2.25	1.00

Annex D (Normative)

Base Metal Grouping

This annex is part of AWS B2.1/B2.1M:2009-ADD1, *Specification for Welding Procedure and Performance Qualification*, and includes mandatory elements for use with this standard.

D1. Base Metal Specifications

Table D.1 indexes ASTM, ABS, API, AS, AS/NZS, CSA, AMS, ISO, NACE, and MSS base metals in numerical order to provide ease of reference when determining into what grouping a particular base metal specification falls.

Table D.2 groups base metals for welding procedure and performance qualification on the basis of mechanical properties, chemical composition, and metallurgical compatibility to minimize the number of welding qualification where this can logically be done.

Table D.3 lists base metal specifications for iron castings in accordance with AWS D11.2 groups.

D2. Material Number (M-Number) Groupings

Base metal has been divided into general categories, e.g., Material Numbers (M-Numbers) 1, 1A, 3, 3A, 4, 4A, etc., and further divided into groups within each general category.

The category grouping does not imply that base metals may be substituted for other base metals within the same Material Number (M-Number) without consideration for weldability.

D3. Iron Castings Specifications

Base metal specifications for iron castings are divided into D11.2 groups.

Table D.1
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 27	1	1	Grade 60-30	J03000	Castings
ASTM	A 27	1	1	Grade U-60-30	J03000	Castings
ASTM	A 27	1	1	Grade 65-35	J03001	Castings
ASTM	A 27	1	2	Grade 70-36	J03501	Castings
ASTM	A 27	1	2	Grade 70-40	J02501	Castings
ASTM	A 31	1	1	Grade B	K03100	Rivets
ASTM	A 36	1	1	A36	K02595	Plate
ASTM	A 36	1	1	A36	K02596	Plate & Bars
ASTM	A 36	1	1	A36	K02597	Plate & Bars
ASTM	A 36	1	1	A36	K02598	Plate & Bars
ASTM	A 36	1	1	A36	K02599	Plate & Bars
ASTM	A 36	1	1	A36	K02600	Shapes
ASTM	A 53	1	1	Type E, Grade A	K02504	Resistance Welded Pipe
ASTM	A 53	1	1	Type E, Grade B	K03005	Resistance Welded Pipe
ASTM	A 53	1	1	Type F, Grade A	—	Furnace Welded Pipe
ASTM	A 53	1	1	Type S, Grade A	K02504	Seamless Pipe
ASTM	A 53	1	1	Type S, Grade B	K03005	Seamless Pipe
ASTM	A 105	1	2	—	K03504	Pipe Flanges
ASTM	A 106	1	1	Grade A	K02501	Seamless Pipe
ASTM	A 106	1	1	Grade B	K03006	Seamless Pipe
ASTM	A 106	1	2	Grade C	K03501	Seamless Pipe
ASTM	A 108	1	1	Grade 1015 CW	G10150	Bar
ASTM	A 108	1	1	Grade 1018 CW	G10180	Bar
ASTM	A 108	1	1	Grade 1020 CW	G10200	Bar
ASTM	A 131	1	1	Grade A	K02300	Structural
ASTM	A 131	1	1	Grade B	K02102	Structural
ASTM	A 131	1	1	Grade CS	K01601	Structural
ASTM	A 131	1	1	Grade D	K02101	Structural
ASTM	A 131	1	1	Grade DS	K01601	Structural
ASTM	A 131	1	2	Grade E	K01801	Structural
ASTM	A 131	1	2	Grade AH32	K11846	Structural
ASTM	A 131	1	2	Grade AH36	K11852	Structural
ASTM	A 131	1	2	Grade DH32	K11846	Structural
ASTM	A 131	1	2	Grade DH36	K11852	Structural
ASTM	A 131	1	2	Grade EH32	K11846	Structural
ASTM	A 131	1	2	Grade EH36	K11852	Structural
ASTM	A 134	1	1	A36	—	Welded Pipe
ASTM	A 134	1	1	A283 A	—	Welded Pipe
ASTM	A 134	1	1	A283 B	—	Welded Pipe
ASTM	A 134	1	1	A283 C	K02401	Welded Pipe
ASTM	A 134	1	1	A283 D	K02702	Welded Pipe
ASTM	A 134	1	1	A285 A	K01700	Welded Pipe
ASTM	A 134	1	1	A285 B	K02200	Welded Pipe

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 134	1	1	A285 C	K02801	Welded Pipe
ASTM	A 135	1	1	Grade A	—	ERW Pipe
ASTM	A 135	1	1	Grade B	—	ERW Pipe
ASTM	A 139	1	1	Grade A	—	Welded Pipe
ASTM	A 139	1	1	Grade B	K03003	Welded Pipe
ASTM	A 139	1	1	Grade C	K03004	Welded Pipe
ASTM	A 139	1	1	Grade D	K03010	Welded Pipe
ASTM	A 139	1	1	Grade E	K03012	Welded Pipe
ASTM	A 148	4	3	Grade 90-60	—	Castings
ASTM	A 161	1	1	Low Carbon	K01504	Low C Tube
ASTM	A 161	3	1	Grade T1	K11522	Tube
ASTM	A 167	8	2	Type 308	S30800	Plate, Sheet & Strip
ASTM	A 167	8	2	Type 309	S30900	Plate, Sheet & Strip
ASTM	A 167	8	2	Type 309S	S30908	Plate, Sheet & Strip
ASTM	A 167	8	2	Type 310	S31000	Plate, Sheet & Strip
ASTM	A 167	8	2	Type 310S	S31008	Plate, Sheet & Strip
ASTM	A 178	1	1	Grade A	K01200	ERW Tube
ASTM	A 178	1	1	Grade C	K03503	ERW Tube
ASTM	A 178	1	2	Grade D	—	ERW Tube
ASTM	A 179	1	1	—	K01200	Seamless Tube
ASTM	A 181	1	1	Class 60	K03502	Pipe Flanges
ASTM	A 181	1	2	Class 70	K03502	Pipe Flanges
ASTM	A 182	3	2	Grade F2	K12122	Pipe Flanges & Fittings
ASTM	A 182	3	2	Grade F1	K12822	Pipe Flanges & Fittings
ASTM	A 182	4	1	Grade F12, Class 1	K11562	Pipe Flanges & Fittings
ASTM	A 182	4	1	Grade F12, Class 2	K11564	Pipe Flanges & Fittings
ASTM	A 182	4	1	Grade F11, Class 2	K11572	Pipe Flanges & Fittings
ASTM	A 182	4	1	Grade F11, Class 3	K11572	Pipe Flanges & Fittings
ASTM	A 182	4	1	Grade F11, Class 1	K11597	Pipe Flanges & Fittings
ASTM	A 182	5A	1	Grade F22, Class 1	K21590	Pipe Flanges & Fittings
ASTM	A 182	5A	1	Grade F22, Class 3	K21590	Pipe Flanges & Fittings
ASTM	A 182	5A	1	Grade F21	K31545	Pipe Flanges & Fittings
ASTM	A 182	5B	1	Grade F5	K41545	Pipe Flanges & Fittings
ASTM	A 182	5B	1	Grade F5a	K42544	Pipe Flanges & Fittings
ASTM	A 182	5B	1	Grade F9	K90941	Pipe Flanges & Fittings
ASTM	A 182	5B	2	Grade F91	K90901	Pipe Flanges & Fittings
ASTM	A 182	5C	1	Grade F3V	K31830	Pipe Flanges & Fittings
ASTM	A 182	6	1	Grade F6a, Class 1	S41000	Pipe Flanges & Fittings
ASTM	A 182	6	2	Grade F429	S42900	Pipe Flanges & Fittings
ASTM	A 182	6	3	Grade F6a, Class 2	S41000	Pipe Flanges & Fittings
ASTM	A 182	6	3	Grade F6a, Class 3	S41000	Pipe Flanges & Fittings
ASTM	A 182	6	3	Grade F6a, Class 4	S41000	Pipe Flanges & Fittings
ASTM	A 182	6	3	Grade F6b	S41026	Pipe Flanges & Fittings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 182	6	4	Grade F6NM	S41500	Pipe Flanges & Fittings
ASTM	A 182	7	2	Grade F430	S43000	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F304	S30400	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F304L	S30403	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F304H	S30409	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F304N	S30451	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F304LN	S30453	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F46	S30600	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F316	S31600	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F316L	S31603	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F316H	S31609	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F316N	S31651	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F316LN	S31653	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F317	S31700	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F317L	S31703	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F321	S32100	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F321H	S32109	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F347	S34700	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F347H	S34709	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F348	S34800	Pipe Flanges & Fittings
ASTM	A 182	8	1	Grade F348H	S34809	Pipe Flanges & Fittings
ASTM	A 182	8	2	Grade F10	S33100	Pipe Flanges & Fittings
ASTM	A 182	8	2	Grade F45	S30815	Pipe Flanges & Fittings
ASTM	A 182	8	2	Grade F310	S31000	Pipe Flanges & Fittings
ASTM	A 182	8	3	Grade FXM-19	S20910	Pipe Flanges & Fittings
ASTM	A 182	8	3	Grade FXM-11	S21904	Pipe Flanges & Fittings
ASTM	A 182	8	4	Grade F44	S31254	Pipe Flanges & Fittings
ASTM	A 182	9A	1	Grade FR	K22035	Pipe Flanges & Fittings
ASTM	A 182	10H	1	Grade F50	S31200	Pipe Flanges & Fittings
ASTM	A 182	10H	1	Grade F51	S31803	Pipe Flanges & Fittings
ASTM	A 182	10H	1	Grade F53	S32750	Flanges & Fittings
ASTM	A 182	10H	1	Grade F55	S32760	Flanges & Fittings
ASTM	A 182	10H	1	Grade F60	S32205	Flanges & Fittings
ASTM	A 182	10H	1	Grade F61	S32550	Flanges & Fittings
ASTM	A 182	10I	1	Grade FXM-27Cb	S44627	Pipe Flanges & Fittings
ASTM	A 192	1	1	—	K01201	Seamless Tube
ASTM	A 199	4	1	Grade T11	K11597	Seamless Tube
ASTM	A 199	5A	1	Grade T21	K31545	Seamless Tube
ASTM	A 199	5A	1	Grade T22	K21590	Seamless Tube
ASTM	A 199	5A	1	Grade T4	K31509	Seamless Tube
ASTM	A 199	5B	1	Grade T5	K41545	Seamless Tube
ASTM	A 199	5B	1	Grade T9	K81590	Seamless Tube
ASTM	A 199	5B	2	Grade T91	S50460	Seamless Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 200	5A	1	Grade T21	K31545	Tube
ASTM	A 200	5A	1	Grade T22	K21590	Tube
ASTM	A 200	5A	1	Grade T4	K31509	Tube
ASTM	A 202	4	1	Grade A	K11742	Plate
ASTM	A 202	4	1	Grade B	K12542	Plate
ASTM	A 203	9A	1	Grade A	K21703	Plate
ASTM	A 203	9A	1	Grade B	K22103	Plate
ASTM	A 203	9B	1	Grade F	K30018	Plate
ASTM	A 203	9B	1	Grade D	K31718	Plate
ASTM	A 203	9B	1	Grade E	K32018	Plate
ASTM	A 204	3	1	Grade A	K11820	Plate
ASTM	A 204	3	2	Grade B	K12020	Plate
ASTM	A 204	3	2	Grade C	K12320	Plate
ASTM	A 209	3	1	Grade T1	K11522	Seamless Tube
ASTM	A 209	3	1	Grade T1a	K12023	Seamless Tube
ASTM	A 209	3	1	Grade T1b	K11422	Seamless Tube
ASTM	A 210	1	1	Grade A1	K02707	Seamless Tube
ASTM	A 210	1	2	Grade C	K03501	ERW Tube
ASTM	A 213	3	1	Grade T2	K11547	Seamless Tube
ASTM	A 213	4	1	Grade T12	K11562	Seamless Tube
ASTM	A 213	4	1	Grade T11	K11597	Seamless Tube
ASTM	A 213	5A	1	Grade T22	K21590	Seamless Tube
ASTM	A 213	5A	1	Grade T21	K31545	Seamless Tube
ASTM	A 213	5B	1	Grade T5c	K41245	Seamless Tube
ASTM	A 213	5B	1	Grade T5	K41545	Seamless Tube
ASTM	A 213	5B	1	Grade T5b	K51545	Seamless Tube
ASTM	A 213	5B	1	Grade T9	K90941	Seamless Tube
ASTM	A 213	5B	2	Grade T91	K90901	Seamless Tube
ASTM	A 213	8	1	TP304	S30400	Seamless Tube
ASTM	A 213	8	1	TP304L	S30403	Seamless Tube
ASTM	A 213	8	1	TP304H	S30409	Seamless Tube
ASTM	A 213	8	1	TP304N	S30451	Seamless Tube
ASTM	A 213	8	1	TP304LN	S30453	Seamless Tube
ASTM	A 213	8	1	TP316	S31600	Seamless Tube
ASTM	A 213	8	1	TP316L	S31603	Seamless Tube
ASTM	A 213	8	1	TP316H	S31609	Seamless Tube
ASTM	A 213	8	1	TP316N	S31651	Seamless Tube
ASTM	A 213	8	1	TP316LN	S31653	Seamless Tube
ASTM	A 213	8	1	TP321	S32100	Seamless Tube
ASTM	A 213	8	1	TP321H	S32109	Seamless Tube
ASTM	A 213	8	1	TP347	S34700	Seamless Tube
ASTM	A 213	8	1	TP347H	S34709	Seamless Tube
ASTM	A 213	8	1	TP348	S34800	Seamless Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 213	8	1	TP348H	S34809	Seamless Tube
ASTM	A 213	8	1	Grade XM-15	S38100	Seamless Tube
ASTM	A 213	8	2	TP253MA	S30815	Seamless Tube
ASTM	A 213	8	2	TP309S	S30908	Seamless Tube
ASTM	A 213	8	2	Type 309H	S30909	Seamless Tube
ASTM	A 213	8	2	TP309Cb	S30940	Seamless Tube
ASTM	A 213	8	2	Type 309HCb	S30941	Seamless Tube
ASTM	A 213	8	2	Type 310	S31000	Seamless Tube
ASTM	A 213	8	2	TP310S	S31008	Seamless Tube
ASTM	A 213	8	2	Type 310H	S31009	Seamless Tube
ASTM	A 213	8	2	TP310Cb	S31040	Seamless Tube
ASTM	A 213	8	2	Type 310HCb	S31041	Seamless Tube
ASTM	A 213	8	2	TP310MoLN	S31050	Seamless Tube
ASTM	A 213	8	3	TP201	S20100	Seamless Tube
ASTM	A 213	8	3	TP202	S20200	Seamless Tube
ASTM	A 213	8	4	TP317 LM	S31725	Seamless Tube
ASTM	A 213	8	4	TP317LMN	S31726	Seamless Tube
ASTM	A 213	10B	1	Grade T17	K12047	Seamless Tube
ASTM	A 214	1	1	—	K01807	ERW Tube
ASTM	A 216	1	1	Grade WCA	J02502	Castings
ASTM	A 216	1	2	Grade WCB	J03002	Castings
ASTM	A 216	1	2	Grade WCC	J02503	Castings
ASTM	A 217	3	1	Grade WC1	J12524	Castings
ASTM	A 217	4	1	Grade WC4	J12082	Castings
ASTM	A 217	4	1	Grade WC5	J22000	Castings
ASTM	A 217	4	1	Grade WC6	J12072	Castings
ASTM	A 217	5A	1	Grade WC9	J21890	Castings
ASTM	A 217	5B	1	Grade C12	J82090	Castings
ASTM	A 217	5B	1	Grade C5	J42025	Castings
ASTM	A 217	5B	1	Grade C12A	J84090	Castings
ASTM	A 217	6	3	Grade CA15	J91150	Castings
ASTM	A 225	10A	1	Grade C	K12524	Plate
ASTM	A 225	10A	1	Grade D	—	Plate
ASTM	A 226	1	1	—	K01201	ERW Tube
ASTM	A 234	1	1	Grade WPB	K03006	Pipe Fittings
ASTM	A 234	1	2	Grade WPC	K03501	Pipe Fittings
ASTM	A 234	3	1	Grade WP1	K12821	Pipe Fittings
ASTM	A 234	4	1	Grade WP11, Class 1	—	Pipe Fittings
ASTM	A 234	4	1	Grade WP12, Class 1	K12062	Pipe Fittings
ASTM	A 234	4	2	Grade WP11, Class 2	—	Pipe Fittings
ASTM	A 234	4	2	Grade WP11, Class 3	—	Pipe Fittings
ASTM	A 234	4	2	Grade WP12, Class 2	K12062	Pipe Fittings
ASTM	A 234	5A	1	Grade WP22, Class 3	K21590	Pipe Fittings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 234	5A	1	Grade WP22, Class 1	K21590	Pipe Fittings
ASTM	A 234	5B	1	Grade WP5	K41545	Pipe Fittings
ASTM	A 234	5B	1	Grade WP9	K90941	Pipe Fittings
ASTM	A 234	5B	2	Grade WP91	S50460	Pipe Fittings
ASTM	A 234	9A	1	Grade WPR	K22035	Pipe Fittings
ASTM	A 240	6	1	Type 410	S41000	Plate
ASTM	A 240	6	2	Type 429	S42900	Plate
ASTM	A 240	6	4	Grade S41500	S41500	Plate
ASTM	A 240	7	1	Type 405	S40500	Plate
ASTM	A 240	7	1	Type 409	S40900	Plate
ASTM	A 240	7	1	Type 410S	S41008	Plate
ASTM	A 240	7	2	Type 18-2	S44400	Plate
ASTM	A 240	7	2	Type 430	S43000	Plate
ASTM	A 240	7	2	Type 439	S43035	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 18-15	S30600	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 302	S30200	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 304	S30400	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 304H	S30409	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 304L	S30403	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 304LN	S30453	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 304N	S30451	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 305	S30500	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 316	S31600	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 316Cb	S31640	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 316H	S31609	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 316L	S31603	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 316LN	S31653	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 316N	S31651	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 316Ti	S31635	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 317	S31700	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 317L	S31703	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 317LN	S31753	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 321	S32100	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 321H	S32109	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 347	S34700	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 347H	S34709	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 348	S34800	Plate, Sheet & Strip
ASTM	A 240	8	1	Type 348H	S34809	Plate, Sheet & Strip
ASTM	A 240	8	1	Type XM-15	S38100	Plate, Sheet & Strip
ASTM	A 240	8	1	Type XM-21	S30452	Plate
ASTM	A 240	8	2	Type 310 MoLN	S31050	Plate, Sheet & Strip
ASTM	A 240	8	2	Type 309HCb	S30941	Plate, Sheet & Strip
ASTM	A 240	8	2	Type 309Cb	S30940	Plate, Sheet & Strip

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 240	8	2	Type 309H	S30909	Plate, Sheet & Strip
ASTM	A 240	8	2	Type 309S	S30908	Plate, Sheet & Strip
ASTM	A 240	8	2	Type 310S	S31008	Plate, Sheet & Strip
ASTM	A 240	8	2	Type 310Cb	S31040	Plate, Sheet & Strip
ASTM	A 240	8	2	S30815	S30815	Plate, Sheet & Strip
ASTM	A 240	8	3	S21800	S21800	Plate, Sheet & Strip
ASTM	A 240	8	3	Type 201-1	S20100	Plate, Sheet & Strip
ASTM	A 240	8	3	Type 202	S20200	Plate, Sheet & Strip
ASTM	A 240	8	3	Type XM-17	S21600	Plate
ASTM	A 240	8	3	Type XM-18	S21603	Plate
ASTM	A 240	8	3	Type XM-19	S20910	Plate
ASTM	A 240	8	3	Type XM-29	S24000	Plate
ASTM	A 240	8	4	Type 317LHM	S31726	Plate, Sheet & Strip
ASTM	A 240	8	4	Type 317LM	S31725	Plate, Sheet & Strip
ASTM	A 240	8	4	S31254	S31254	Plate, Sheet & Strip
ASTM	A 240	10H	1	S31200	S31200	Plate, Sheet & Strip
ASTM	A 240	10H	1	S31260	S31260	Plate, Sheet & Strip
ASTM	A 240	10H	1	S31803	S31803	Plate, Sheet & Strip
ASTM	A 240	10H	1	—	S32101	Plate, Sheet & Strip
ASTM	A 240	10H	1	S32205	S32205	Plate, Sheet & Strip
ASTM	A 240	10H	1	—	S32750	Plate, Sheet & Strip
ASTM	A 240	10H	1	—	S32760	Plate, Sheet & Strip
ASTM	A 240	10H	1	Type 255	S32550	Plate, Sheet & Strip
ASTM	A 240	10H	1	S32950	S32950	Plate
ASTM	A 240	10H	1	Type 329	S32900	Plate, Sheet & Strip
ASTM	A 240	10I	1	S44635	S44635	Plate, Sheet & Strip
ASTM	A 240	10I	1	Type XM-27	S44627	Plate, Sheet & Strip
ASTM	A 240	10I	1	Type XM-33	S44626	Plate, Sheet & Strip
ASTM	A 240	10J	1	Grade 29-4	S44700	Plate, Sheet & Strip
ASTM	A 240	10K	1	S44800	S44800	Plate
ASTM	A 240	10K	1	S44660	S44660	Plate
ASTM	A 242	1	2	Type 1	K11510	Shapes, Plates & Bars
ASTM	A 249	8	1	TP316LN	S31653	Welded Tube
ASTM	A 249	8	1	TP316N	S31651	Welded Tube
ASTM	A 249	8	1	TP317	S31700	Welded Tube
ASTM	A 249	8	1	TP317L	S31703	Welded Tube
ASTM	A 249	8	1	TP321	S32100	Welded Tube
ASTM	A 249	8	1	TP321H	S32109	Welded Tube
ASTM	A 249	8	1	TP347	S34700	Welded Tube
ASTM	A 249	8	1	TP347H	S34709	Welded Tube
ASTM	A 249	8	1	TP348	S34800	Welded Tube
ASTM	A 249	8	1	TP348H	S34809	Welded Tube
ASTM	A 249	8	1	Type 304	S30400	Welded Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 249	8	1	Type 304H	S30409	Welded Tube
ASTM	A 249	8	1	Type 304L	S30403	Welded Tube
ASTM	A 249	8	1	Type 304LN	S30453	Welded Tube
ASTM	A 249	8	1	Type 304N	S30451	Welded Tube
ASTM	A 249	8	1	Type 316	S31600	Welded Tube
ASTM	A 249	8	1	Type 316H	S31609	Welded Tube
ASTM	A 249	8	1	Type 316L	S31603	Welded Tube
ASTM	A 249	8	1	Type XM-15	S38100	Welded Tube
ASTM	A 249	8	2	S30815	S30815	Welded Tube
ASTM	A 249	8	2	TP309Cb	S30940	Welded Tube
ASTM	A 249	8	2	TP309H	S30909	Welded Tube
ASTM	A 249	8	2	TP309HCb	S30941	Welded Tube
ASTM	A 249	8	2	TP309S	S30908	Welded Tube
ASTM	A 249	8	2	TP310Cb	S31040	Welded Tube
ASTM	A 249	8	2	TP310H	S31009	Welded Tube
ASTM	A 249	8	2	TP310S	S31008	Welded Tube
ASTM	A 249	8	2	Type 309	S30900	Welded Tube
ASTM	A 249	8	2	Type 310 MoLN	S31050	Welded Tube
ASTM	A 249	8	3	TP201	S20100	Welded Tube
ASTM	A 249	8	3	TP202	S20200	Welded Tube
ASTM	A 249	8	3	TPXM-19	S20910	Welded Tube
ASTM	A 249	8	3	TPXM-29	S24000	Welded Tube
ASTM	A 249	8	4	317LH	S31726	Welded Tube
ASTM	A 249	8	4	317LM	S31725	Welded Tube
ASTM	A 249	8	4	S31254	S31254	Welded Tube
ASTM	A 250	3	1	Grade T1	K11522	ERW Tube
ASTM	A 250	3	1	Grade T1a	K12023	ERW Tube
ASTM	A 250	3	1	Grade T1b	K11422	ERW Tube
ASTM	A 250	3	1	Grade T2	K11547	ERW Tube
ASTM	A 250	4	1	Grade T11	K11597	ERW Tube
ASTM	A 250	5A	1	Grade T22	K21590	ERW Tube
ASTM	A 252	1	1	Grade 1		Pipe Piles
ASTM	A 252	1	1	Grade 2		Pipe Piles
ASTM	A 252	1	1	Grade 3		Pipe Piles
ASTM	A 266	1	1	Grade 1	K03506	Seamless Forging
ASTM	A 266	1	2	Grade 2	K03506	Seamless Forging
ASTM	A 266	1	2	Grade 3	K05001	Seamless Forging
ASTM	A 266	1	2	Grade 4	K03017	Seamless Forging
ASTM	A 268	6	1	Type 410	S41000	Tube
ASTM	A 268	6	2	Type 429	S42900	Tube
ASTM	A 268	6	4	S41500	S41500	Seamless & Welded Tube
ASTM	A 268	7	1	S40800	S40800	Seamless & Welded Tube
ASTM	A 268	7	1	Type 405	S40500	Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 268	7	1	Type 409	S40900	Tube
ASTM	A 268	7	1	Type 430Ti	S43036	Seamless & Welded Tube
ASTM	A 268	7	2	Type 18Cr-2Mo	S44400	Seamless & Welded Tube
ASTM	A 268	7	2	Type 430	S43000	Tube
ASTM	A 268	7	2	Type 439	S43035	Seamless & Welded Tube
ASTM	A 268	10I	1	Grade 25-4-4	S44635	Seamless & Welded Tube
ASTM	A 268	10I	1	TPXM-27	S44627	Seamless & Welded Tube
ASTM	A 268	10I	1	TPXM-33	S44626	Seamless & Welded Tube
ASTM	A 268	10I	1	Type 446-1	S44600	Seamless & Welded Tube
ASTM	A 268	10I	1	Type 446-2	S44600	Seamless & Welded Tube
ASTM	A 268	10J	1	Grade 29-4	S44700	Seamless & Welded Pipe
ASTM	A 268	10J	1	S44735	S44735	Seamless & Welded Pipe
ASTM	A 268	10K	1	Grade 26-3-3	S44660	Seamless & Welded Tube
ASTM	A 268	10K	1	Grade 29-4-2	S44800	Seamless & Welded Tube
ASTM	A 269	8	1	TP304	S30400	Seamless & Welded Pipe
ASTM	A 269	8	1	TP304L	S30403	Seamless & Welded Pipe
ASTM	A 269	8	1	TP316	S31600	Seamless & Welded Pipe
ASTM	A 269	8	1	TP316L	S31603	Seamless & Welded Pipe
ASTM	A 269	8	1	Type 304LN	S30453	Seamless & Welded Pipe
ASTM	A 269	8	1	Type 316LN	S31653	Seamless & Welded Pipe
ASTM	A 269	8	1	Type 317	S31700	Seamless & Welded Pipe
ASTM	A 269	8	1	Type 321	S32100	Seamless & Welded Pipe
ASTM	A 269	8	1	Type 347	S34700	Seamless & Welded Pipe
ASTM	A 269	8	1	Type 348	S34800	Seamless & Welded Pipe
ASTM	A 269	8	3	Type XM-10	S21900	Tube
ASTM	A 269	8	3	Type XM-11	S21904	Tube
ASTM	A 269	8	3	Type XM-15	S38100	Tube
ASTM	A 269	8	3	Type XM-19	S20910	Tube
ASTM	A 269	8	3	Type XM-29	S24000	Tube
ASTM	A 270	8	1	Type 304	S30400	Seamless & Welded Pipe
ASTM	A 271	8	1	Type 304	S30400	Seamless Tube
ASTM	A 271	8	1	Type 304H	S30409	Seamless Tube
ASTM	A 271	8	1	Type 316	S31600	Seamless Tube
ASTM	A 271	8	1	Type 316H	S31609	Seamless Tube
ASTM	A 271	8	1	Type 321	S32100	Seamless Tube
ASTM	A 271	8	1	Type 321H	S32109	Seamless Tube
ASTM	A 271	8	1	Type 347	S34700	Seamless Tube
ASTM	A 271	8	1	Type 347H	S34709	Seamless Tube
ASTM	A 276	6	1	Type 410	S41000	Bar
ASTM	A 276	8	1	Type 304	S30400	Bar
ASTM	A 276	8	1	Type 304L	S30403	Bar
ASTM	A 276	8	1	Type 316	S31600	Bar
ASTM	A 276	8	1	Type 316L	S31603	Bar

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 276	10H	1	—	S32101	Bar & Shapes
ASTM	A 276	10H	1	—	S32205	Bar & Shapes
ASTM	A 276	10H	1	—	S32550	Bar & Shapes
ASTM	A 283	1	1	Grade A	K01804	Plate
ASTM	A 283	1	1	Grade B	K02001	Plate
ASTM	A 283	1	1	Grade C	K02401	Plate
ASTM	A 283	1	1	Grade D	K02702	Plate
ASTM	A 285	1	1	Grade A	K01700	Plate
ASTM	A 285	1	1	Grade B	K02200	Plate
ASTM	A 285	1	1	Grade C	K02801	Plate
ASTM	A 297	8	2	HE	J93403	Castings
ASTM	A 297	8	2	HF	J92603	Castings
ASTM	A 297	8	2	HH	J93503	Castings
ASTM	A 297	8	2	HI	J94003	Castings
ASTM	A 297	8	2	HK	J94224	Castings
ASTM	A 299	1	2	Grade A	K02803	Plate
ASTM	A 302	3	2	Grade A	K12021	Plate
ASTM	A 302	3	3	Grade B	K12022	Plate & Sheet
ASTM	A 302	3	3	Grade C	K12039	Plate & Sheet
ASTM	A 302	3	3	Grade D	K12054	Plate & Sheet
ASTM	A 312	8	1	TP304	S30400	Seamless & Welded Pipe
ASTM	A 312	8	1	TP304H	S30409	Seamless & Welded Pipe
ASTM	A 312	8	1	TP304L	S30403	Seamless & Welded Pipe
ASTM	A 312	8	1	TP304LN	S30453	Seamless & Welded Pipe
ASTM	A 312	8	1	TP304N	S30451	Seamless & Welded Pipe
ASTM	A 312	8	1	TP316	S31600	Seamless & Welded Pipe
ASTM	A 312	8	1	TP316H	S31609	Seamless & Welded Pipe
ASTM	A 312	8	1	TP316L	S31603	Seamless & Welded Pipe
ASTM	A 312	8	1	TP316LN	S31653	Seamless & Welded Pipe
ASTM	A 312	8	1	TP316N	S31651	Seamless & Welded Pipe
ASTM	A 312	8	1	TP317	S31700	Seamless & Welded Pipe
ASTM	A 312	8	1	TP317L	S31703	Seamless & Welded Pipe
ASTM	A 312	8	1	TP321	S32100	Seamless & Welded Pipe
ASTM	A 312	8	1	TP321	S32100	Seamless & Welded Pipe
ASTM	A 312	8	1	TP321H	S32109	Seamless & Welded Pipe
ASTM	A 312	8	1	TP321H	S32109	Seamless & Welded Pipe
ASTM	A 312	8	1	TP347	S34700	Seamless & Welded Pipe
ASTM	A 312	8	1	TP347H	S34709	Seamless & Welded Pipe
ASTM	A 312	8	1	TP348	S34800	Seamless & Welded Pipe
ASTM	A 312	8	1	TP348H	S34809	Seamless & Welded Pipe
ASTM	A 312	8	1	TPXM-15	S38100	Seamless & Welded Pipe
ASTM	A 312	8	2	S30815	S30815	Seamless & Welded Pipe
ASTM	A 312	8	2	TP309Cb	S30940	Seamless & Welded Pipe

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 312	8	2	TP309H	S30909	Seamless & Welded Pipe
ASTM	A 312	8	2	TP309HCb	S30941	Seamless & Welded Pipe
ASTM	A 312	8	2	TP309S	S30908	Seamless & Welded Pipe
ASTM	A 312	8	2	TP310Cb	S31040	Seamless & Welded Pipe
ASTM	A 312	8	2	TP310H	S31000	Seamless & Welded Pipe
ASTM	A 312	8	2	TP310HCb	S31041	Seamless & Welded Pipe
ASTM	A 312	8	2	TP310MoLN	S31050	Welded Pipe
ASTM	A 312	8	2	TP310S	S31008	Seamless & Welded Pipe
ASTM	A 312	8	3	TPXM-19	S20910	Seamless & Welded Pipe
ASTM	A 312	8	3	TP-11	S21904	Seamless & Welded Pipe
ASTM	A 312	8	3	TPXM-29	S24000	Seamless & Welded Pipe
ASTM	A 312	8	4	317LM	S31725	Seamless & Welded Pipe
ASTM	A 312	8	4	317LM	S31726	Seamless & Welded Pipe
ASTM	A 312	8	4	S31254	S31254	Seamless & Welded Pipe
ASTM	A 333	1	1	Grade 1	K03008	Seamless & Welded Pipe
ASTM	A 333	1	1	Grade 6	K03006	Seamless & Welded Pipe
ASTM	A 333	1	3	Grade 10	—	Pipe
ASTM	A 333	4	2	Grade 4	K11267	Pipe
ASTM	A 333	9A	1	Grade 7	K21903	Pipe
ASTM	A 333	9A	1	Grade 9	K22035	Pipe
ASTM	A 333	9B	1	Grade 3	K31918	Pipe
ASTM	A 333	11A	1	Grade 8	K81340	Seamless & Welded Pipe
ASTM	A 334	1	1	Grade 1	K03008	Welded Tube
ASTM	A 334	1	1	Grade 6	K03006	Welded Tube
ASTM	A 334	9A	1	Grade 7	K21903	Tube
ASTM	A 334	9A	1	Grade 9	K22035	Tube
ASTM	A 334	9B	1	Grade 3	K31918	Tube
ASTM	A 334	11A	1	Grade 8	K81340	Tube
ASTM	A 335	3	1	Grade P1	K11522	Seamless Pipe
ASTM	A 335	3	1	Grade P15	K11578	Seamless Pipe
ASTM	A 335	3	1	Grade P2	K11547	Seamless Pipe
ASTM	A 335	4	1	Grade P11	K11597	Pipe
ASTM	A 335	4	1	Grade P12	K11562	Pipe
ASTM	A 335	5A	1	Grade P21	K31545	Seamless Pipe
ASTM	A 335	5A	1	Grade P22	K21590	Seamless Pipe
ASTM	A 335	5B	1	Grade P5	K41545	Seamless Pipe
ASTM	A 335	5B	1	Grade P5b	K51545	Seamless Pipe
ASTM	A 335	5B	1	Grade P5c	K41245	Seamless Pipe
ASTM	A 335	5B	1	Grade P9	S50400	Seamless Pipe
ASTM	A 335	5B	2	Grade P91	K91560	Seamless Pipe
ASTM	A 336	3	2	Grade F1	K12520	Forging
ASTM	A 336	4	1	Grade F11, Class 1	K11597	Forging
ASTM	A 336	4	1	Grade F11, Class 2	K11572	Forging

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 336	4	1	Grade F11, Class 3	K11572	Forging
ASTM	A 336	4	1	Grade F12	K11564	Forging
ASTM	A 336	5A	1	Grade F21, Class 1	K31545	Forging
ASTM	A 336	5A	1	Grade F21, Class 3	K31545	Forging
ASTM	A 336	5A	1	Grade F22, Class 1	K21590	Forging
ASTM	A 336	5A	1	Grade F22, Class 3	K21590	Forging
ASTM	A 336	5B	1	Grade F5	K41545	Forging
ASTM	A 336	5B	1	Grade F5A	K42544	Forging
ASTM	A 336	5B	1	Grade F9	K90941	Forging
ASTM	A 336	5B	2	Grade F91	K90901	Forging
ASTM	A 336	5C	1	Grade F3V	K31830	Forging
ASTM	A 336	6	3	Grade F6	S41000	Forging
ASTM	A 336	8	1	F304	S30400	Forging
ASTM	A 336	8	1	F304H	S30409	Forging
ASTM	A 336	8	1	F304L	S30403	Forging
ASTM	A 336	8	1	F304LN	S30453	Forging
ASTM	A 336	8	1	F304N	S30451	Forging
ASTM	A 336	8	1	F316	S31600	Forging
ASTM	A 336	8	1	F316H	S31609	Forging
ASTM	A 336	8	1	F316L	S31603	Forging
ASTM	A 336	8	1	F316LN	S31653	Forging
ASTM	A 336	8	1	F316N	S31651	Forging
ASTM	A 336	8	1	F321	S32100	Forging
ASTM	A 336	8	1	F321H	S32109	Forging
ASTM	A 336	8	1	F347	S34700	Forging
ASTM	A 336	8	1	F347H	S34709	Forging
ASTM	A 336	8	1	F348	S34800	Forging
ASTM	A 336	8	1	F348H	S34809	Forging
ASTM	A 336	8	2	F310	S31000	Forging
ASTM	A 336	8	3	FXM-11	S21904	Forging
ASTM	A 336	8	3	FXM-19	S20910	Forging
ASTM	A 336	8	4	F46	S30600	Forging
ASTM	A 336	10I	1	Grade FXM-27Cb	S44627	Forging
ASTM	A 350	1	1	Grade LF1	K03009	Forging
ASTM	A 350	1	2	Grade LF787, Class 2	—	Forging
ASTM	A 350	1	2	Grade LF2	K03011	Forging
ASTM	A 350	1	2	Grade LF6	K12202	Forging
ASTM	A 350	1	3	Grade LF6, Class 2	K12202	Forging
ASTM	A 350	1	3	Grade LF6, Class 3	K12202	Forging
ASTM	A 350	1	3	Grade LF787, Class 3	—	Forging
ASTM	A 350	9A	1	Grade LF5, Class 1	K13050	Forging
ASTM	A 350	9A	1	Grade LF5, Class 2	K13050	Forging
ASTM	A 350	9A	1	Grade LF9	K22036	Forging

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 350	9B	1	Grade LF3, Class 2	K32025	Forging
ASTM	A 351	8	1	CF10	J92590	Castings
ASTM	A 351	8	1	CF10M	J92901	Castings
ASTM	A 351	8	1	CF10MC	—	Castings
ASTM	A 351	8	1	CF3	J92500	Castings
ASTM	A 351	8	1	CF3A	J92500	Castings
ASTM	A 351	8	1	CF3M	J92800	Castings
ASTM	A 351	8	1	CF8	J92600	Castings
ASTM	A 351	8	1	CF8A	J92600	Castings
ASTM	A 351	8	1	CF8C	J92710	Castings
ASTM	A 351	8	1	CF8M	J92900	Castings
ASTM	A 351	8	1	CG8M	J93000	Castings
ASTM	A 351	8	2	CE20N	J92802	Castings
ASTM	A 351	8	2	CH10	J93401	Castings
ASTM	A 351	8	2	CH20	J93402	Castings
ASTM	A 351	8	2	CH8	J93400	Castings
ASTM	A 351	8	2	CK20	J94202	Castings
ASTM	A 351	8	2	HK40	J94204	Castings
ASTM	A 351	8	3	CG6MMN	J93790	Castings
ASTM	A 351	10H	1	CD4MCu	J93370	Castings
ASTM	A 351	10H	1	CD3MWCuN	J93380	Castings
ASTM	A 351	10H	1	CE8MN	—	Castings
ASTM	A 352	1	1	Grade LCA	J02504	Castings
ASTM	A 352	1	1	Grade LCB	J03003	Castings
ASTM	A 352	1	2	Grade LCC	J02505	Castings
ASTM	A 352	3	1	Grade LC1	J12522	Castings
ASTM	A 352	6	4	Grade CA6NM	J91540	Castings
ASTM	A 352	9A	1	Grade LC2	J22500	Castings
ASTM	A 352	9B	1	Grade LC3	J31550	Castings
ASTM	A 352	9C	1	Grade LC4	J41500	Castings
ASTM	A 352	11A	5	Grade LC2-1	J42215	Castings
ASTM	A 353	11A	1	—	K81340	Plate
ASTM	A 358	8	1	304	S30400	Welded Pipe
ASTM	A 358	8	1	304H	S30409	Welded Pipe
ASTM	A 358	8	1	304L	S30403	Welded Pipe
ASTM	A 358	8	1	304LN	S30453	Welded Pipe
ASTM	A 358	8	1	304N	S30451	Welded Pipe
ASTM	A 358	8	1	316	S31600	Welded Pipe
ASTM	A 358	8	1	316H	S31609	Welded Pipe
ASTM	A 358	8	1	316L	S31603	Welded Pipe
ASTM	A 358	8	1	316LN	S31653	Welded Pipe
ASTM	A 358	8	1	316N	S31651	Welded Pipe
ASTM	A 358	8	1	321	S32100	Welded Pipe

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 358	8	1	347	S34700	Welded Pipe
ASTM	A 358	8	1	348	S34800	Welded Pipe
ASTM	A 358	8	2	253MA	S30815	Welded Pipe
ASTM	A 358	8	2	309	S30900	Welded Pipe
ASTM	A 358	8	2	309Cb	S30940	Welded Pipe
ASTM	A 358	8	2	309S	S30908	Welded Pipe
ASTM	A 358	8	2	310	S31000	Welded Pipe
ASTM	A 358	8	2	310Cb	S31040	Welded Pipe
ASTM	A 358	8	2	310S	S31008	Welded Pipe
ASTM	A 358	8	3	XM-19	S20910	Welded Pipe
ASTM	A 358	8	3	XM-29	S24000	Welded Pipe
ASTM	A 358	8	4	317L4	S31726	Welded Pipe
ASTM	A 358	8	4	317LM	S31725	Welded Pipe
ASTM	A 358	8	4	S31254	S31254	Welded Pipe
ASTM	A 366	1	1	Commercial Quality	—	Sheet
ASTM	A 369	1	1	Grade FPA	K02501	Forged Pipe
ASTM	A 369	1	1	Grade FPB	K03006	Forged Pipe
ASTM	A 369	3	1	Grade FP1	K11522	Forged Pipe
ASTM	A 369	3	1	Grade FP2	K11547	Forged Pipe
ASTM	A 369	4	1	Grade FP11	K11597	Forged Pipe
ASTM	A 369	4	1	Grade FP12	K11562	Forged Pipe
ASTM	A 369	5A	1	Grade FP21	K31545	Forged Pipe
ASTM	A 369	5A	1	Grade FP22	K21590	Forged Pipe
ASTM	A 369	5B	1	Grade FP5	K41545	Forged Pipe
ASTM	A 369	5B	1	Grade FP9	K90941	Forged Pipe
ASTM	A 369	5B	2	Grade FP91	S50460	Forged Pipe
ASTM	A 372	1	1	Grade A or Type 1	K03002	Forging
ASTM	A 372	1	2	Grade B	K04001	Forging
ASTM	A 376	8	1	16-8-2H	S16800	Seamless Pipe
ASTM	A 376	8	1	TP304	S30400	Seamless Pipe
ASTM	A 376	8	1	TP304H	S30409	Seamless Pipe
ASTM	A 376	8	1	TP304LN	S30453	Seamless Pipe
ASTM	A 376	8	1	TP304N	S30451	Seamless Pipe
ASTM	A 376	8	1	TP316	S31600	Seamless Pipe
ASTM	A 376	8	1	TP316H	S31609	Seamless Pipe
ASTM	A 376	8	1	TP316LN	S31653	Seamless Pipe
ASTM	A 376	8	1	TP316N	S31651	Seamless Pipe
ASTM	A 376	8	1	TP321	S32100	Seamless Pipe
ASTM	A 376	8	1	TP321H	S32109	Seamless Pipe
ASTM	A 376	8	1	TP347	S34700	Seamless Pipe
ASTM	A 376	8	1	TP347H	S34709	Seamless Pipe
ASTM	A 376	8	1	TP348	S34800	Seamless Pipe
ASTM	A 376	8	4	317L4	S31726	Seamless Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 376	8	4	317LM	S31725	Seamless Tube
ASTM	A 381	1	1	Class Y35	K03013	Pipe
ASTM	A 381	1	1	Class Y42	—	Pipe
ASTM	A 381	1	1	Class Y46	—	Pipe
ASTM	A 381	1	1	Class Y48	—	Pipe
ASTM	A 381	1	2	Class Y50	—	Pipe
ASTM	A 381	1	2	Class Y52	—	Pipe
ASTM	A 381	1	2	Class Y56	—	Pipe
ASTM	A 387	3	1	Grade 2, Class 1	K12143	Plate
ASTM	A 387	3	2	Grade 2, Class 2	K12143	Plate
ASTM	A 387	4	1	Grade 11, Class 1	K11789	Plate
ASTM	A 387	4	1	Grade 11, Class 2	K11789	Plate
ASTM	A 387	4	1	Grade 12, Class 1	K11757	Plate
ASTM	A 387	4	1	Grade 12, Class 2	K11757	Plate
ASTM	A 387	5A	1	Grade 21, Class 1	K31545	Plate
ASTM	A 387	5A	1	Grade 21, Class 2	K31545	Plate
ASTM	A 387	5A	1	Grade 22, Class 1	K21590	Plate
ASTM	A 387	5A	1	Grade 22, Class 2	K21590	Plate
ASTM	A 387	5B	1	Grade 5, Class 1	K41545	Plate
ASTM	A 387	5B	1	Grade 5, Class 2	K41545	Plate
ASTM	A 387	5B	2	Grade 91, Class 2	S50460	Plate
ASTM	A 389	4	1	Grade C23	J12080	Castings
ASTM	A 389	4	1	Grade C24	J12092	Castings
ASTM	A 403	8	1	WP304	S30400	Pipe Fittings
ASTM	A 403	8	1	WP304H	S30409	Pipe Fittings
ASTM	A 403	8	1	WP304L	S30403	Pipe Fittings
ASTM	A 403	8	1	WP304LN	S30453	Pipe Fittings
ASTM	A 403	8	1	WP304N	S30451	Pipe Fittings
ASTM	A 403	8	1	WP316	S31600	Pipe Fittings
ASTM	A 403	8	1	WP316H	S31609	Pipe Fittings
ASTM	A 403	8	1	WP316L	S31603	Pipe Fittings
ASTM	A 403	8	1	WP316LN	S31653	Pipe Fittings
ASTM	A 403	8	1	WP316N	S31651	Pipe Fittings
ASTM	A 403	8	1	WP317	S31700	Pipe Fittings
ASTM	A 403	8	1	WP317L	S31703	Pipe Fittings
ASTM	A 403	8	1	WP321	S32100	Pipe Fittings
ASTM	A 403	8	1	WP321H	S32109	Pipe Fittings
ASTM	A 403	8	1	WP347	S34700	Pipe Fittings
ASTM	A 403	8	1	WP347H	S34709	Pipe Fittings
ASTM	A 403	8	1	WP348	S34800	Pipe Fittings
ASTM	A 403	8	1	WP348H	S34809	Pipe Fittings
ASTM	A 403	8	2	WP309	S30900	Pipe Fittings
ASTM	A 403	8	2	WP310	S31000	Pipe Fittings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 403	8	3	WPXM-19	S20910	Pipe Fittings
ASTM	A 405	4	1	Grade P24	K11591	Cast Pipe
ASTM	A 409	8	1	TP304	S30400	Welded Pipe
ASTM	A 409	8	1	TP304L	S30403	Welded Pipe
ASTM	A 409	8	1	TP316	S31600	Welded Pipe
ASTM	A 409	8	1	TP316L	S31603	Welded Pipe
ASTM	A 409	8	1	TP317	S31700	Welded Pipe
ASTM	A 409	8	1	TP321	S32100	Welded Pipe
ASTM	A 409	8	1	TP347	S34700	Welded Pipe
ASTM	A 409	8	1	TP348	S34800	Welded Pipe
ASTM	A 409	8	2	253MA	S30815	Welded Pipe
ASTM	A 409	8	2	TP309Cb	S30940	Welded Pipe
ASTM	A 409	8	4	317L4	S31726	Welded Pipe
ASTM	A 409	8	4	317LM	S31725	Welded Pipe
ASTM	A 409	8	4	S31254	S31254	Welded Pipe
ASTM	A 414	1	1	Grade A	K01501	Sheet
ASTM	A 414	1	1	Grade B	K02201	Sheet
ASTM	A 414	1	1	Grade C	K02503	Sheet
ASTM	A 414	1	1	Grade D	K02505	Sheet
ASTM	A 414	1	1	Grade E	K02704	Sheet
ASTM	A 414	1	2	Grade F	K03102	Sheet
ASTM	A 414	1	2	Grade G	K03103	Sheet
ASTM	A 420	1	1	Grade WPL6	—	Pipe Fittings
ASTM	A 420	9A	1	Grade WPL9	K22035	Pipe Fittings
ASTM	A 420	9B	1	Grade WPL3	—	Pipe Fittings
ASTM	A 420	11A	1	Grade WPL8	K81340	Pipe Fittings
ASTM	A 423	4	2	Grade 1	K11535	Tube
ASTM	A 423	4	2	Grade 2	K11540	Tube
ASTM	A 426	3	1	Grade CP1	J12521	Centrifugal Cast Pipe
ASTM	A 426	3	1	Grade CP15	J11522	Centrifugal Cast Pipe
ASTM	A 426	3	1	Grade CP2	J11547	Centrifugal Cast Pipe
ASTM	A 426	4	1	Grade CP11	J12072	Centrifugal Cast Pipe
ASTM	A 426	4	1	Grade CP12	J11562	Centrifugal Cast Pipe
ASTM	A 426	5A	1	Grade CP21	J31545	Centrifugal Cast Pipe
ASTM	A 426	5A	1	Grade CP22	J21890	Centrifugal Cast Pipe
ASTM	A 426	5B	1	Grade CP5	J42045	Centrifugal Cast Pipe
ASTM	A 426	5B	1	Grade CP5b	J51545	Centrifugal Cast Pipe
ASTM	A 426	5B	1	Grade CP9	J82090	Centrifugal Cast Pipe
ASTM	A 426	6	3	Grade CPCA15	J91150	Centrifugal Cast Pipe
ASTM	A 430	8	1	FP16-8-2H	S16800	Forged Pipe
ASTM	A 430	8	1	FP304	S30400	Forged Pipe
ASTM	A 430	8	1	FP304H	S30409	Forged Pipe
ASTM	A 430	8	1	FP304N	S30451	Forged Pipe

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 430	8	1	FP316	S31600	Forged Pipe
ASTM	A 430	8	1	FP316H	S31609	Forged Pipe
ASTM	A 430	8	1	FP316N	S31651	Forged Pipe
ASTM	A 430	8	1	FP321	S32100	Forged Pipe
ASTM	A 430	8	1	FP321H	S32109	Forged Pipe
ASTM	A 430	8	1	FP347	S34700	Forged Pipe
ASTM	A 430	8	1	FP347H	S34709	Forged Pipe
ASTM	A 441	1	2	—	K12211	Shapes, Plates, and Bars
ASTM	A 451	8	1	CPF10MC	J92971	Centrifugal Cast Pipe
ASTM	A 451	8	1	CPF3	J92500	Centrifugal Cast Pipe
ASTM	A 451	8	1	CPF3A	J92500	Centrifugal Cast Pipe
ASTM	A 451	8	1	CPF3M	J92800	Centrifugal Cast Pipe
ASTM	A 451	8	1	CPF8	J92600	Centrifugal Cast Pipe
ASTM	A 451	8	1	CPF8A	J92600	Centrifugal Cast Pipe
ASTM	A 451	8	1	CPF8C	J92710	Centrifugal Cast Pipe
ASTM	A 451	8	1	CPF8M	J92900	Centrifugal Cast Pipe
ASTM	A 452	8	1	TP304H	S30409	Centrifugal Cast Pipe
ASTM	A 452	8	1	TP316H	S31609	Centrifugal Cast Pipe
ASTM	A 452	8	1	TP347H	S34709	Centrifugal Cast Pipe
ASTM	A 455	1	2	—	K03300	Plate
ASTM	A 473	8	1	Type 302	S30200	Forging
ASTM	A 473	8	1	Type 302B	S30215	Forging
ASTM	A 473	8	1	Type 303	S30300	Forging
ASTM	A 473	8	1	Type 303Se	S30323	Forging
ASTM	A 473	8	1	Type 304	S30400	Forging
ASTM	A 473	8	1	Type 304L	S30403	Forging
ASTM	A 473	8	1	Type 305	S30500	Forging
ASTM	A 473	8	1	Type 316	S31600	Forging
ASTM	A 473	8	1	Type 316L	S31603	Forging
ASTM	A 473	8	1	Type 317	S31700	Forging
ASTM	A 473	8	1	Type 321	S32100	Forging
ASTM	A 473	8	1	Type 347	S34700	Forging
ASTM	A 473	8	1	Type 348	S34800	Forging
ASTM	A 473	6	1	Type 403	S40300	Forging
ASTM	A 473	6	1	Type 410	S41000	Forging
ASTM	A 473	6	1	Type 414	S41400	Forging
ASTM	A 473	6	2	Type 405	S40500	Forging
ASTM	A 473	6	2	Type 420	S42000	Forging
ASTM	A 473	6	2	Type 429	S42900	Forging
ASTM	A 473	6	2	Type 430	S43000	Forging
ASTM	A 473	8	2	Type 308	S30800	Forging
ASTM	A 473	8	2	Type 314	S31400	Forging
ASTM	A 473	8	3	Type 202	S20200	Forging

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 473	8	3	Type XM-10	S21900	Forging
ASTM	A 473	8	3	Type XM-11	S21904	Forging
ASTM	A 479	6	1	Type 403	S40300	Bars & Shapes
ASTM	A 479	6	1	Type 410	S41000	Bars & Shapes
ASTM	A 479	6	3	Type 414	S41400	Bars & Shapes
ASTM	A 479	6	4	S41500	S41500	Bars & Shapes
ASTM	A 479	7	1	Type 405	S40500	Bars & Shapes
ASTM	A 479	7	2	Type 444	S44400	Bars & Shapes
ASTM	A 479	7	2	Type 430	S43000	Bars & Shapes
ASTM	A 479	7	2	Type 439	S43035	Bars & Shapes
ASTM	A 479	7	3	Type XM-30	S41040	Bars & Shapes
ASTM	A 479	8	1	304H	S30409	Bars & Shapes
ASTM	A 479	8	1	304L	S30403	Bars & Shapes
ASTM	A 479	8	1	304LN	S30453	Bars & Shapes
ASTM	A 479	8	1	304N	S30451	Bars & Shapes
ASTM	A 479	8	1	316Cb	S31640	Bars & Shapes
ASTM	A 479	8	1	316H	S31609	Bars & Shapes
ASTM	A 479	8	1	316L	S31603	Bars & Shapes
ASTM	A 479	8	1	316LN	S31653	Bars & Shapes
ASTM	A 479	8	1	316N	S31651	Bars & Shapes
ASTM	A 479	8	1	316Ti	S31635	Bars & Shapes
ASTM	A 479	8	1	321H	S32109	Bars & Shapes
ASTM	A 479	8	1	347H	S34709	Bars & Shapes
ASTM	A 479	8	1	348H	S34809	Bars & Shapes
ASTM	A 479	8	1	306	S30600	Bars & Shapes
ASTM	A 479	8	1	Type 302	S30200	Bars & Shapes
ASTM	A 479	8	1	Type 304	S30400	Bars & Shapes
ASTM	A 479	8	1	Type 316	S31600	Bars & Shapes
ASTM	A 479	8	1	Type 321	S32100	Bars & Shapes
ASTM	A 479	8	1	Type 347	S34700	Bars & Shapes
ASTM	A 479	8	1	Type 348	S34800	Bars & Shapes
ASTM	A 479	8	3	S21800	S21800	Bars & Shapes
ASTM	A 479	8	3	XM-11	S21904	Bars & Shapes
ASTM	A 479	8	3	XM-17	S21600	Bars & Shapes
ASTM	A 479	8	3	XM-18	S21603	Bars & Shapes
ASTM	A 479	8	3	XM-19	S20910	Bars & Shapes
ASTM	A 479	8	3	XM-29	S24000	Bars & Shapes
ASTM	A 479	8	4	317L4	S31726	Bars & Shapes
ASTM	A 479	8	4	317LM	S31725	Bars & Shapes
ASTM	A 479	8	4	S31254	S31254	Bars & Shapes
ASTM	A 479	10H	1	F255	S32550	Bars & Shapes
ASTM	A 479	10H	1	—	S31803	Bars & Shapes
ASTM	A 479	10H	1	—	S32101	Bars & Shapes

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 479	10H	1	—	S32205	Bars & Shapes
ASTM	A 479	10H	1	—	S32550	Bars & Shapes
ASTM	A 479	10I	1	Type XM-27	S44627	Bars & Shapes
ASTM	A 479	10J	1	Grade 28-4	S44700	Bars & Shapes
ASTM	A 479	10K	1	Grade 28-4-2	S44800	Bars & Shapes
ASTM	A 487	1	2	Grade 16, Class A	J31200	Castings
ASTM	A 487	3	3	Grade 4, Class C	J13047	Castings
ASTM	A 487	5C	1	Grade 8, Class A	J22091	Castings
ASTM	A 487	5C	4	Grade 8, Class B	J22091	Castings
ASTM	A 487	5C	4	Grade 8, Class C	J22091	Castings
ASTM	A 487	6	3	Grade CA15, Class B	J91450	Castings
ASTM	A 487	6	3	Grade CA15, Class C	J91171	Castings
ASTM	A 487	6	3	Grade CA15, Class D	J91171	Castings
ASTM	A 487	6	3	Grade CA15M, Class A	J91451	Castings
ASTM	A 487	6	4	Grade CA6NM, Class A	J91540	Castings
ASTM	A 487	6	4	Grade CA6NM, Class B	J91540	Castings
ASTM	A 487	10A	1	Grade 1, Class A	J13002	Castings
ASTM	A 487	10A	1	Grade 1, Class B	J13002	Castings
ASTM	A 487	10A	1	Grade Mn-V	J13002	Castings
ASTM	A 487	10F	1	Grade 2, Class A	J13005	Castings
ASTM	A 487	10F	1	Grade 2, Class B	J13005	Castings
ASTM	A 487	10F	1	Grade 4, Class A	J13047	Castings
ASTM	A 487	11A	3	Grade 4, Class B	J13047	Castings
ASTM	A 487	11A	3	Grade 4, Class E	J13047	Castings
ASTM	A 500	1	1	Grade A	K03000	Tube
ASTM	A 500	1	1	Grade B	K03000	Tube
ASTM	A 500	1	1	Grade C	K02705	Tube
ASTM	A 500	1	1	Grade D	—	Tube
ASTM	A 501	1	1	—	K03000	Tube
ASTM	A 501	1	1	Grade A	—	Tube
ASTM	A 501	1	2	Grade B	—	Tube
ASTM	A 508	1	2	Grade 1	K13502	Forging
ASTM	A 508	1	2	Grade 1A	K13502	Forging
ASTM	A 508	3	3	Grade 2, Class 1	K12766	Forging
ASTM	A 508	3	3	Grade 2, Class 2	K12766	Forging
ASTM	A 508	3	3	Grade 3, Class 1	K12042	Forging
ASTM	A 508	3	3	Grade 3, Class 2	K12042	Forging
ASTM	A 508	3	3	Grade 4N, Class 3	K22375	Forging
ASTM	A 508	5C	1	Grade 3V	K31830	Forging
ASTM	A 508	11A	5	Grade 4N, Class 1	K22375	Forging
ASTM	A 508	11A	5	Grade 4N, Class 2	K22375	Forging
ASTM	A 508	11A	5	Grade 5, Class 1	K42365	Forging
ASTM	A 508	11A	5	Grade 5, Class 2	K42365	Forging

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 511	8	1	MT 302	S30200	Tube
ASTM	A 511	8	1	MT 304	S30400	Tube
ASTM	A 511	8	1	MT 304L	S30403	Tube
ASTM	A 511	8	1	MT 316	S31600	Tube
ASTM	A 511	8	1	MT 316L	S31603	Tube
ASTM	A 511	8	1	MT 317	S31700	Tube
ASTM	A 511	8	1	MT 321	S32100	Tube
ASTM	A 511	8	1	MT 347	S34700	Tube
ASTM	A 511	8	2	MT 309S	S30908	Tube
ASTM	A 511	8	2	MT 310S	S31008	Tube
ASTM	A 512	1	1	Grade 1010	G10100	Mechanical Tube
ASTM	A 512	1	1	Grade 1015	G10150	Mechanical Tube
ASTM	A 512	1	1	Grade 1018	G10180	Mechanical Tube
ASTM	A 512	1	1	Grade 1020	G10200	Mechanical Tube
ASTM	A 512	1	1	Grade 1025	G10250	Mechanical Tube
ASTM	A 512	1	1	Grade 1117	G11170	Mechanical Tube
ASTM	A 512	1	1	Grade MT1010	G10100	Mechanical Tube
ASTM	A 512	1	1	Grade MT1015	G10150	Mechanical Tube
ASTM	A 512	1	1	Grade MT1020	G10200	Mechanical Tube
ASTM	A 512	1	1	Grade MTX1015	—	Mechanical Tube
ASTM	A 512	1	1	Grade MTX1020	—	Mechanical Tube
ASTM	A 512	1	2	Grade 1030	G10300	Mechanical Tube
ASTM	A 513	1	1	Grade 1008	G10080	Mechanical Tube
ASTM	A 513	1	1	Grade 1010	G10100	Mechanical Tube
ASTM	A 513	1	1	Grade 1015	G10150	Mechanical Tube
ASTM	A 513	1	1	Grade 1015 CW	G10150	Mechanical Tube
ASTM	A 513	1	1	Grade 1017	G10170	Mechanical Tube
ASTM	A 513	1	1	Grade 1018	G10180	Mechanical Tube
ASTM	A 513	1	1	Grade 1019	G10190	Mechanical Tube
ASTM	A 513	1	1	Grade 1020	G10200	Mechanical Tube
ASTM	A 513	1	1	Grade 1021	G10210	Mechanical Tube
ASTM	A 513	1	1	Grade 1025	G10250	Mechanical Tube
ASTM	A 513	1	1	Grade MT1010	G10110	Mechanical Tube
ASTM	A 513	1	1	Grade MT1015	G10150	Mechanical Tube
ASTM	A 513	1	1	Grade MT1020	G10200	Mechanical Tube
ASTM	A 513	1	1	Grade MTX1015	—	Mechanical Tube
ASTM	A 513	1	1	Grade MTX1020	—	Mechanical Tube
ASTM	A 513	1	2	Grade 1020 CW	G10200	Mechanical Tube
ASTM	A 513	1	2	Grade 1025 CW	G10250	Mechanical Tube
ASTM	A 513	1	2	Grade 1026	G10260	Mechanical Tube
ASTM	A 513	1	2	Grade 1030	G10300	Mechanical Tube
ASTM	A 514	11B	1	Grade A	K11856	Plate
ASTM	A 514	11B	2	Grade E	K11856	Plate

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 514	11B	3	Grade F	K11576	Plate & Shapes
ASTM	A 514	11B	3	Grade H	K21604	Plate & Shapes
ASTM	A 514	11B	4	Grade B	K11576	Plate
ASTM	A 514	11B	6	Grade C	K11511	Plate & Shapes
ASTM	A 514	11B	6	Grade J	K11625	Plate & Shapes
ASTM	A 514	11B	6	Grade K	K11523	Plate & Shapes
ASTM	A 514	11B	6	Grade S	—	Plate
ASTM	A 514	11B	6	Grade T	—	Plate & Shapes
ASTM	A 514	11B	8	Grade P	K21650	Plate & Shapes
ASTM	A 514	11B	9	Grade Q	—	Plate
ASTM	A 514	11B	10	Grade M	—	Plate & Shapes
ASTM	A 514	11B	12	Grade R	—	Plate & Shapes
ASTM	A 515	1	1	Grade 55	K02001	Plate
ASTM	A 515	1	1	Grade 60	K02401	Plate
ASTM	A 515	1	1	Grade 65	K02800	Plate
ASTM	A 515	1	2	Grade 70	K03101	Plate
ASTM	A 516	1	1	Grade 55	K01800	Plate
ASTM	A 516	1	1	Grade 60	K02100	Plate
ASTM	A 516	1	1	Grade 65	K02403	Plate
ASTM	A 516	1	2	Grade 70	K02700	Plate
ASTM	A 517	11B	1	Grade A	K11856	Plate
ASTM	A 517	11B	2	Grade E	K21604	Plate
ASTM	A 517	11B	3	Grade F	K11576	Plate
ASTM	A 517	11B	3	Grade H	K21604	Plate
ASTM	A 517	11B	4	Grade B	K11630	Plate
ASTM	A 517	11B	6	Grade J	K11625	Plate
ASTM	A 517	11B	6	Grade K	K11523	Plate
ASTM	A 517	11B	6	Grade S	—	Plate
ASTM	A 517	11B	6	Grade T	—	Plate
ASTM	A 517	11B	8	Grade P	K21650	Plate
ASTM	A 517	11B	9	Grade Q	—	Plate
ASTM	A 517	11B	10	Grade M	K11683	Plate
ASTM	A 519	1	1	Grade 1008	G10080	Mechanical Tube
ASTM	A 519	1	1	Grade 1012	G10120	Mechanical Tube
ASTM	A 519	1	1	Grade 1016	G10160	Mechanical Tube
ASTM	A 519	1	1	Grade 1017	G10170	Mechanical Tube
ASTM	A 519	1	1	Grade 1018	G10180	Mechanical Tube
ASTM	A 519	1	1	Grade 1018 HR	G10180	Mechanical Tube
ASTM	A 519	1	1	Grade 1019	G10190	Mechanical Tube
ASTM	A 519	1	1	Grade 1020	G10200	Mechanical Tube
ASTM	A 519	1	1	Grade 1020 HR	G10200	Mechanical Tube
ASTM	A 519	1	1	Grade 1021	G10210	Mechanical Tube
ASTM	A 519	1	1	Grade 1022	G10220	Mechanical Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 519	1	1	Grade 1022 HR	G10220	Mechanical Tube
ASTM	A 519	1	1	Grade 1025	G10250	Mechanical Tube
ASTM	A 519	1	1	Grade 1025 HR	G10250	Mechanical Tube
ASTM	A 519	1	1	Grade 1026	G10260	Mechanical Tube
ASTM	A 519	1	1	Grade 1026 HR	G10260	Mechanical Tube
ASTM	A 519	1	1	Grade MT1010	G10100	Mechanical Tube
ASTM	A 519	1	1	Grade MT1015	G10150	Mechanical Tube
ASTM	A 519	1	1	Grade MT1020	G10200	Mechanical Tube
ASTM	A 519	1	1	Grade MTX1015	G10150	Mechanical Tube
ASTM	A 519	1	2	Grade 1030	G10300	Mechanical Tube
ASTM	A 519	11B	9	Grade 4130	G41300	Mechanical Tube
ASTM	A 519	11B	9	Grade 8630	G86300	Mechanical Tube
ASTM	A 521	1	1	Class CC	—	Die Forging
ASTM	A 521	1	1	Class CCI	—	Die Forging
ASTM	A 521	1	2	Class CE	—	Forging
ASTM	A 522	11A	1	Type I	K81340	Forging
ASTM	A 522	11A	1	Type II	K71340	Forging
ASTM	A 523	1	1	Grade A	KO2504	Pipe
ASTM	A 523	1	1	Grade B	KO3005	Pipe
ASTM	A 524	1	1	Grade I	KO2104	Pipe
ASTM	A 524	1	1	Grade II	KO2104	Pipe
ASTM	A 526	1	1	Grade II	KO2104	Galvanized Sheet
ASTM	A 527	1	1	Grade II	KO2104	Galvanized Sheet
ASTM	A 529	1	1	Grade 42	KO2703	Structural
ASTM	A 529	1	2	Grade 50	—	Bar, Plate & Shapes
ASTM	A 529	1	2	Grade 55	—	Bar, Plate & Shapes
ASTM	A 533	3	3	Type A, Class 1	K12521	Plate
ASTM	A 533	3	3	Type A, Class 2	K12521	Plate
ASTM	A 533	3	3	Type B, Class 1	K12539	Plate
ASTM	A 533	3	3	Type B, Class 2	K12539	Plate
ASTM	A 533	3	3	Type C, Class 1	K12554	Plate
ASTM	A 533	3	3	Type C, Class 2	K12554	Plate
ASTM	A 533	3	3	Type D, Class 1	K12529	Plate
ASTM	A 533	3	3	Type D, Class 2	K12529	Plate
ASTM	A 533	11A	4	Grade A, Class 3	K12521	Plate
ASTM	A 533	11A	4	Grade B, Class 3	K12539	Plate
ASTM	A 533	11A	4	Grade C, Class 3	K12554	Plate
ASTM	A 533	11A	4	Grade D, Class 3	K12529	Plate
ASTM	A 537	1	2	Class 1	K02400	Plate
ASTM	A 537	1	3	Class 2	K02400	Plate
ASTM	A 537	1	3	Class 3	K02400	Plate
ASTM	A 539	1	1	—	K01506	Coiled Tube
ASTM	A 541	1	2	Grade 1	K03506	Forging

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 541	1	2	Grade 1A	—	Forging
ASTM	A 541	3	3	Grade 2, Class 1	K12765	Forging
ASTM	A 541	3	3	Grade 2, Class 2	K12765	Forging
ASTM	A 541	3	3	Grade 3, Class 1	K12045	Forging
ASTM	A 541	3	3	Grade 3, Class 2	K12045	Forging
ASTM	A 541	4	1	Grade 11, Class 4	K11572	Forging
ASTM	A 541	5C	1	Grade 22, Class 3	K21390	Forging
ASTM	A 541	5C	1	Grade 3V	K31830	Forging
ASTM	A 541	5C	4	Grade 22, Class 4	K21390	Forging
ASTM	A 541	5C	5	Grade 22, Class 5	K21390	Forging
ASTM	A 542	5C	1	Type A, Class 4	K21590	Plate & Sheet
ASTM	A 542	5C	1	Type A, Class 4a	K21590	Plate & Sheet
ASTM	A 542	5C	1	Type B, Class 4	K21590	Plate & Sheet
ASTM	A 542	5C	1	Type B, Class 4a	K21590	Plate & Sheet
ASTM	A 542	5C	1	Type C, Class 4	K31830	Plate & Sheet
ASTM	A 542	5C	1	Type C, Class 4a	K31830	Plate & Sheet
ASTM	A 542	5C	1	Type D, Class 4a	K31835	Plate & Sheet
ASTM	A 542	5C	3	Type A, Class 3	K21590	Plate
ASTM	A 542	5C	3	Type B, Class 3	K21590	Plate
ASTM	A 542	5C	3	Type C, Class 3	K31830	Plate
ASTM	A 542	5C	4	Type A, Class 1	K21590	Plate
ASTM	A 542	5C	4	Type B, Class 1	K21590	Plate
ASTM	A 542	5C	4	Type C, Class 1	K31830	Plate
ASTM	A 542	5C	5	Type A, Class 2	K21590	Plate
ASTM	A 542	5C	5	Type B, Class 2	K21590	Plate
ASTM	A 542	5C	5	Type C, Class 2	K31830	Plate
ASTM	A 543	11A	5	Type B, Class 1	K42339	Plate
ASTM	A 543	11A	5	Type B, Class 3	K42339	Plate
ASTM	A 543	11A	5	Type C, Class 1	K42338	Plate
ASTM	A 543	11A	5	Type C, Class 3	K42338	Plate
ASTM	A 543	11B	10	Type B, Class 2	K42339	Plate
ASTM	A 543	11B	10	Type C, Class 2	K42338	Plate
ASTM	A 553	11A	1	Type I	K81340	Plate
ASTM	A 553	11A	1	Type II	K71340	Plate
ASTM	A 554	8	1	MT 302	S30200	Tube
ASTM	A 554	8	1	MT 304	S30400	Tube
ASTM	A 554	8	1	MT 304L	S30403	Tube
ASTM	A 554	8	1	MT 316	S31600	Tube
ASTM	A 554	8	1	MT 316L	S31603	Tube
ASTM	A 554	8	1	MT 317	S31700	Tube
ASTM	A 554	8	1	MT 321	S32100	Tube
ASTM	A 554	8	1	MT 347	S34700	Tube
ASTM	A 554	8	2	MT 309S	S30908	Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 554	8	2	MT 309S-Cb	S30940	Tube
ASTM	A 554	8	2	MT 310S	S31008	Tube
ASTM	A 556	1	1	Grade A2	K01807	Seamless Tube
ASTM	A 556	1	1	Grade B2	K02707	Seamless Tube
ASTM	A 556	1	2	Grade C2	K03006	Seamless Tube
ASTM	A 557	1	1	Grade A2	K01807	Tube-RW
ASTM	A 557	1	1	Grade B2	K03007	Tube-RW
ASTM	A 557	1	2	Grade C2	K03505	ERW Tube
ASTM	A 562	1	1	—	K11224	Plate
ASTM	A 569	1	1	Grade 30	K02502	Sheet & Strip
ASTM	A 569	1	1	Grade 33	K02502	Sheet & Strip
ASTM	A 569	1	1	Grade 36	K02502	Sheet & Strip
ASTM	A 569	1	1	Grade 40	K02502	Sheet & Strip
ASTM	A 569	1	1	Grade 45	K02502	Sheet & Strip
ASTM	A 569	1	1	Grade 50	K02502	Sheet & Strip
ASTM	A 570	1	1	Grade 30	K02502	Sheet & Strip
ASTM	A 570	1	1	Grade 33	K02502	Sheet & Strip
ASTM	A 570	1	1	Grade 36	K02502	Sheet & Strip
ASTM	A 570	1	1	Grade 40	K02502	Sheet & Strip
ASTM	A 570	1	1	Grade 45	K02502	Sheet & Strip
ASTM	A 570	1	1	Grade 50	K02502	Sheet & Strip
ASTM	A 570	1	1	Grade 55	K02502	Sheet & Strip
ASTM	A 572	1	1	Grade 42	K02303	Shapes, Plate & Bars
ASTM	A 572	1	1	Grade 50	K02304	Shapes, Plate & Bars
ASTM	A 572	1	2	Grade 55	—	Plate & Shapes
ASTM	A 572	1	3	Grade 60	K02305	Plate & Bars
ASTM	A 572	1	3	Grade 65	K02306	Shapes
ASTM	A 573	1	1	Grade 58	K02301	Plate
ASTM	A 573	1	1	Grade 65	K02404	Plate
ASTM	A 573	1	2	Grade 70	K02701	Improved Toughness Plate
ASTM	A 575	1	1	Grade M1008	G10080	Bar
ASTM	A 575	1	1	Grade M1010	G10100	Bar
ASTM	A 575	1	1	Grade M1012	G10120	Bar
ASTM	A 575	1	1	Grade M1015	G10150	Bar
ASTM	A 575	1	1	Grade M1017	G10170	Bar
ASTM	A 575	1	1	Grade M1020	G10200	Bar
ASTM	A 575	1	1	Grade M1023	G10230	Bar
ASTM	A 575	1	1	Grade M1025	G10250	Bar
ASTM	A 576	1	1	Grade 1008	G10080	Bar
ASTM	A 576	1	1	Grade 1010	G10100	Bar
ASTM	A 576	1	1	Grade 1012	G10120	Bar
ASTM	A 576	1	1	Grade 1015	G10150	Bar
ASTM	A 576	1	1	Grade 1016	G10160	Bar

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 576	1	1	Grade 1017	G10170	Bar
ASTM	A 576	1	1	Grade 1018	G10180	Bar
ASTM	A 576	1	1	Grade 1019	G10190	Bar
ASTM	A 576	1	1	Grade 1020	G10200	Bar
ASTM	A 576	1	1	Grade 1021	G10210	Bar
ASTM	A 576	1	1	Grade 1022	G10220	Bar
ASTM	A 576	1	1	Grade 1023	G10230	Bar
ASTM	A 576	1	1	Grade 1025	G10250	Bar
ASTM	A 587	1	1	—	K11500	Pipe
ASTM	A 587	1	1	Grade A2	K01807	Tube-RW
ASTM	A 587	1	1	Grade B2	K03007	Tube-RW
ASTM	A 588	1	2	All Grades	—	Structural Shapes
ASTM	A 588	1	2	Grade A	K11430	Plate & Bars
ASTM	A 588	1	2	Grade B	K12043	Plate & Bars
ASTM	A 588	1	2	Grade C	K11538	Plate & Bars
ASTM	A 588	1	2	Grade K	—	Plate & Bars
ASTM	A 592	11B	1	Grade A	K11856	Forging
ASTM	A 592	11B	2	Grade E	K11695	Forging
ASTM	A 592	11B	3	Grade F	K11576	Forging
ASTM	A 595	1	2	Grade A	K02004	Tapered Tube
ASTM	A 595	1	2	Grade B	K02005	Tapered Tube
ASTM	A 595	3	1	Grade C	K11526	Tapered Tube
ASTM	A 606	1	2	Type 2	—	Sheet & Strip
ASTM	A 606	1	2	Type 4	—	Sheet & Strip
ASTM	A 607	1	1	Grade 45	—	Sheet & Strip
ASTM	A 607	1	1	Grade 50	—	Sheet & Strip
ASTM	A 607	1	2	Grade 55	—	Sheet & Strip
ASTM	A 607	1	3	Grade 60	—	Sheet & Strip
ASTM	A 607	1	3	Grade 65	—	Sheet & Strip
ASTM	A 607	1	3	Grade 70	—	Sheet & Strip
ASTM	A 611	1	1	Grade A	G10170	Sheet & Strip
ASTM	A 611	1	1	Grade B	G10170	Sheet & Strip
ASTM	A 611	1	1	Grade C	G10170	Sheet & Strip
ASTM	A 611	1	1	Grade D	G10120	Sheet & Strip
ASTM	A 611	1	3	Grade E	G10170	Sheet & Strip
ASTM	A 612	10C	1	—	K02900	Plate
ASTM	A 615	1A	4	Grade 40	—	Rebar
ASTM	A 615	1A	4	Grade 60	—	Rebar
ASTM	A 618	1	1	Grade III	K12700	Tube
ASTM	A 618	1	2	Grade 1a	—	HSLA Tube
ASTM	A 618	1	2	Grade 1b	K02601	HSLA Tube
ASTM	A 618	1	2	Grade II	K12609	Tube
ASTM	A 620	1	1	Types A	K00040	Sheet

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 620	1	1	Types B	K00040	Sheet
ASTM	A 633	1	1	Grade A	K01802	Plate & Shapes
ASTM	A 633	1	2	Grade C	K12000	HSLA Steel
ASTM	A 633	1	2	Grade D	K12037	HSLA Steel
ASTM	A 633	1	3	Grade E	K12202	HSLA Steel
ASTM	A 645	11A	2	—	K41583	Plate
ASTM	A 653	1	1	Grade 33	—	Galvanized Sheet
ASTM	A 653	1	1	Grade 37	—	Galvanized Sheet
ASTM	A 653	1	1	Grade 40	—	Galvanized Sheet
ASTM	A 653	1	1	Grade 80	—	Galvanized Sheet
ASTM	A 656	1	1	Grade 50	K11804	Hi-Str. Lo-Alloy Plate
ASTM	A 656	1	1	Grade 60	K11804	Hi-Str. Lo-Alloy Plate
ASTM	A 656	1	2	Grade 70	K11804	Hi-Str. Lo-Alloy Plate
ASTM	A 656	1	3	Grade 80	K11804	Hi-Str. Lo-Alloy Plate
ASTM	A 660	1	1	Grade WCA	J02504	Centrifugal Cast Pipe
ASTM	A 660	1	2	Grade WCB	J03003	Centrifugal Cast Pipe
ASTM	A 660	1	2	Grade WCC	J02505	Centrifugal Cast Pipe
ASTM	A 662	1	1	Grade A	K01701	Plate
ASTM	A 662	1	1	Grade B	K02203	Plate
ASTM	A 662	1	2	Grade C	K02007	Plate
ASTM	A 663	1	1	Grade 45	—	Bar, Shapes, Rounds, Squares, Hex.
ASTM	A 663	1	1	Grade 50	—	Bar, Shapes, Rounds, Squares, Hex.
ASTM	A 663	1	1	Grade 55	—	Bar, Shapes, Rounds, Squares, Hex.
ASTM	A 663	1	1	Grade 60	—	Bar, Shapes, Rounds, Squares, Hex.
ASTM	A 663	1	1	Grade 65	—	Bar, Shapes, Rounds, Squares, Hex.
ASTM	A 663	1	3	Grade 70	—	Bar, Shapes, Rounds, Squares, Hex.
ASTM	A 663	1	3	Grade 75	—	Bar, Shapes, Rounds, Squares, Hex.
ASTM	A 663	1	3	Grade 79	—	Flat Bar
ASTM	A 663	1	3	Grade 80	—	Bar, Shapes, Rounds, Squares, Hex.
ASTM	A 666	8	1	Type 302	S30200	Plate, Sheet & Strip
ASTM	A 666	8	1	Type 304	S30400	Plate, Sheet & Strip
ASTM	A 666	8	1	Type 304L	S30403	Plate, Sheet & Strip
ASTM	A 666	8	1	Type 304LN	S30453	Plate, Sheet & Strip
ASTM	A 666	8	1	Type 304N	S30451	Plate, Sheet & Strip
ASTM	A 666	8	1	Type 316	S31600	Plate, Sheet & Strip
ASTM	A 666	8	1	Type 316L	S31603	Plate, Sheet & Strip
ASTM	A 666	8	1	Type 316N	S31651	Plate, Sheet & Strip
ASTM	A 666	8	3	201	S20100	Plate, Sheet & Strip
ASTM	A 666	8	3	XM-11	S21904	Plate, Sheet & Strip
ASTM	A 668	1	1	Class B	G10200	Forging
ASTM	A 668	1	1	Class C	G10250	Forging
ASTM	A 668	1	2	Class D	G10300	Forging
ASTM	A 668	1	3	Class F	—	Forging

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 671	1	1	Grade CA55	K02801	Fusion Welded Pipe
ASTM	A 671	1	1	Grade CB60	K02401	Fusion Welded Pipe
ASTM	A 671	1	1	Grade CB65	K02800	Fusion Welded Pipe
ASTM	A 671	1	1	Grade CC60	K02100	Fusion Welded Pipe
ASTM	A 671	1	1	Grade CC65	K02403	Fusion Welded Pipe
ASTM	A 671	1	1	Grade CE55	—	Fusion Welded Pipe
ASTM	A 671	1	1	Grade CE60	—	Fusion Welded Pipe
ASTM	A 671	1	2	Grade CB70	K03101	Fusion Welded Pipe
ASTM	A 671	1	2	Grade CC70	K02700	Fusion Welded Pipe
ASTM	A 671	1	2	Grade CD70	K02400	Fusion Welded Pipe
ASTM	A 671	1	2	Grade CK75	K02803	Fusion Welded Pipe
ASTM	A 671	1	3	Grade CD80	K02400	Fusion Welded Pipe
ASTM	A 672	1	1	Grade A45	K01700	Fusion Welded Pipe
ASTM	A 672	1	1	Grade A50	K02200	Fusion Welded Pipe
ASTM	A 672	1	1	Grade A55	K02801	Fusion Welded Pipe
ASTM	A 672	1	1	Grade B55	—	Fusion Welded Pipe
ASTM	A 672	1	1	Grade B60	K02401	Fusion Welded Pipe
ASTM	A 672	1	1	Grade B65	K02800	Fusion Welded Pipe
ASTM	A 672	1	1	Grade C55	K01800	Fusion Welded Pipe
ASTM	A 672	1	1	Grade C60	K02100	Fusion Welded Pipe
ASTM	A 672	1	1	Grade C65	K02403	Fusion Welded Pipe
ASTM	A 672	1	1	Grade E55	—	Fusion Welded Pipe
ASTM	A 672	1	1	Grade E60	K02402	Fusion Welded Pipe
ASTM	A 672	1	2	Grade B70	K03101	Fusion Welded Pipe
ASTM	A 672	1	2	Grade C70	K02700	Fusion Welded Pipe
ASTM	A 672	1	2	Grade D70	K02400	Fusion Welded Pipe
ASTM	A 672	1	2	Grade N75	K02803	Fusion Welded Pipe
ASTM	A 672	1	3	Grade D80	K02400	Fusion Welded Pipe
ASTM	A 672	3	1	Grade L65	K11820	Fusion Welded Pipe
ASTM	A 672	3	2	Grade H75	K12021	Fusion Welded Pipe
ASTM	A 672	3	2	Grade L70	K12020	Fusion Welded Pipe
ASTM	A 672	3	2	Grade L75	K12320	Fusion Welded Pipe
ASTM	A 672	3	3	Grade H80	K12022	Fusion Welded Pipe
ASTM	A 672	3	3	Grade J80	K12554	Fusion Welded Pipe
ASTM	A 672	3	3	Grade J90	K12554	Fusion Welded Pipe
ASTM	A 672	11A	4	Grade J100	K12521	Fusion Welded Pipe
ASTM	A 675	1	1	Grade 45	—	Bar
ASTM	A 675	1	1	Grade 50	—	Bar
ASTM	A 675	1	1	Grade 55	—	Bar
ASTM	A 675	1	1	Grade 60	—	Bar
ASTM	A 675	1	1	Grade 65	—	Bar
ASTM	A 675	1	2	Grade 70	—	Bar
ASTM	A 675	1	2	Grade 75	—	Bar

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 678	1	2	Grade A	K01600	Structural Plate
ASTM	A 678	1	2	Grade B	K02002	Structural Plate
ASTM	A 678	1	3	Grade C	K02204	Structural Plate
ASTM	A 678	1	3	Grade C	K02204	Structural Plate
ASTM	A 678	1	3	Grade C	K02204	Structural Plate
ASTM	A 678	1	3	Grade D	K12202	Structural Plate
ASTM	A 688	8	1	TP304	S30400	Welded Tube
ASTM	A 688	8	1	TP304L	S30403	Welded Tube
ASTM	A 688	8	1	TP304LN	S30453	Welded Tube
ASTM	A 688	8	1	TP304N	S30451	Welded Tube
ASTM	A 688	8	1	TP316	S31600	Welded Tube
ASTM	A 688	8	1	TP316L	S31603	Welded Tube
ASTM	A 688	8	1	TP316LN	S31653	Welded Tube
ASTM	A 688	8	1	TP316N	S31651	Welded Tube
ASTM	A 688	8	3	TPXM-29	S24000	Welded Tube
ASTM	A 690	1	2	—	K12249	Marine Piling—Plate & Bar
ASTM	A 691	1	2	Grade CMS-75	K02803	Fusion Welded Pipe
ASTM	A 691	1	2	Grade CMSH-70	K02400	Fusion Welded Pipe
ASTM	A 691	1	3	Grade CMSH-80	K02400	Fusion Welded Pipe
ASTM	A 691	3	1	Grade 1/2 CR, Class 1	K12143	Fusion Welded Pipe
ASTM	A 691	3	1	Grade CM-65, Gr. A	K11820	Fusion Welded Pipe
ASTM	A 691	3	2	Grade 1/2 CR, Class 2	K12143	Fusion Welded Pipe
ASTM	A 691	3	2	Grade CM-70	K12020	Fusion Welded Pipe
ASTM	A 691	3	2	Grade CM-75	K12320	Fusion Welded Pipe
ASTM	A 691	4	1	Grade 1.25CR, Class 1	K11757	Fusion Welded Pipe
ASTM	A 691	4	1	Grade 1.25CR, Class 2	K11789	Fusion Welded Pipe
ASTM	A 691	4	1	Grade 1CR, Class 1	K11757	Fusion Welded Pipe
ASTM	A 691	4	1	Grade 1CR, Class 2	K11789	Fusion Welded Pipe
ASTM	A 691	5A	1	Grade 2-1/4CR, Class 1	K21590	Fusion Welded Pipe
ASTM	A 691	5A	1	Grade 2-1/4CR, Class 2	K21590	Fusion Welded Pipe
ASTM	A 691	5A	1	Grade 3CR, Class 1	K31545	Fusion Welded Pipe
ASTM	A 691	5A	1	Grade 3CR, Class 2	K31545	Fusion Welded Pipe
ASTM	A 691	5B	1	Grade 5CR, Class 1	K41545	Fusion Welded Pipe
ASTM	A 691	5B	1	Grade 5CR, Class 2	K41545	Fusion Welded Pipe
ASTM	A 695	1	1	Type B	K03504	Bar
ASTM	A 695	1	2	Type B, Grade 40	K03504	Bar
ASTM	A 696	1	1	Grade B	K03200	Bar
ASTM	A 696	1	2	Grade C	K03200	Bar
ASTM	A 706	1A	4	—	K03011	Rebar
ASTM	A 707	1	1	Grade L1, Class 1	K02302	Forging
ASTM	A 707	1	1	Grade L2, Class 1	K03301	Forging
ASTM	A 707	1	1	Grade L3, Class 1	K12510	Forging
ASTM	A 707	1	1	Grade L4, Class 1	K12089	Forging

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 707	1	1	Grade L5, Class 1	K20934	Forging
ASTM	A 707	1	2	Grade L1, Class 2	K02302	Forging
ASTM	A 707	1	2	Grade L2, Class 2	K03301	Forging
ASTM	A 707	1	2	Grade L3, Class 2	K12510	Forging
ASTM	A 707	1	2	Grade L4, Class 2	K12089	Forging
ASTM	A 707	1	2	Grade L4, Class 3	K12089	Forging
ASTM	A 707	1	2	Grade L5, Class 2	K20934	Forging
ASTM	A 707	1	3	Grade L2, Class 3	K03301	Forging
ASTM	A 707	1	3	Grade L3, Class 3	K12510	Forging
ASTM	A 707	1	3	Grade L5, Class 3	K20934	Forging
ASTM	A 707	1	4	Grade L5, Class 4	K20934	Forging
ASTM	A 707	3	1	Grade L6, Class 1	K02902	Forging
ASTM	A 707	3	2	Grade L6, Class 2	K02902	Forging
ASTM	A 707	3	3	Grade L6, Class 3	K02902	Forging
ASTM	A 707	3	4	Grade L6, Class 4	K02902	Forging
ASTM	A 707	9B	1	Grade L7, Class 1	K32218	Forging
ASTM	A 707	9B	1	Grade L7, Class 2	K32218	Forging
ASTM	A 707	11A	1	Grade L8, Class 1	K42247	Forging
ASTM	A 707	11A	2	Grade L8, Class 2	K42247	Forging
ASTM	A 707	11A	3	Grade L8, Class 3	K42247	Forging
ASTM	A 707	11A	4	Grade L8, Class 4	K42247	Forging
ASTM	A 709	1	1	Grade 36	—	Plate, Bars & Shapes
ASTM	A 709	1	1	Grade 50	—	Plate, Bars & Shapes
ASTM	A 709	1	1	Grade 50S	—	Plate, Bars & Shapes
ASTM	A 709	1	2	Grade 50W	—	Plate, Bars & Shapes
ASTM	A 709	11B	1	Grade 100, Type A	K11856	Plate & Shapes
ASTM	A 709	11B	1	Grade 100W, Type A	K11856	Plate & Shapes
ASTM	A 709	11B	2	Grade 100, Type E	K21604	Plate & Shapes
ASTM	A 709	11B	2	Grade 100W, Type E	K21604	Plate & Shapes
ASTM	A 709	11B	3	Grade 100, Type F	K11576	Plate & Shapes
ASTM	A 709	11B	3	Grade 100W, Type F	K11576	Plate & Shapes
ASTM	A 709	11B	3	Grade 100, Type H	K21504	Plate & Shapes
ASTM	A 709	11B	3	Grade 100W, Type H	K21504	Plate & Shapes
ASTM	A 709	11B	4	Grade 100, Type B	K11630	Plate & Shapes
ASTM	A 709	11B	4	Grade 100W, Type B	K11630	Plate & Shapes
ASTM	A 709	11B	6	Grade 100, Type C	—	Plate & Shapes
ASTM	A 709	11B	6	Grade 100W, Type C	—	Plate & Shapes
ASTM	A 709	11B	6	Grade 100, Type J	K11625	Plate & Shapes
ASTM	A 709	11B	6	Grade 100W, Type J	K11625	Plate & Shapes
ASTM	A 709	11B	8	Grade 100, Type P	K21650	Plate & Shapes
ASTM	A 709	11B	8	Grade 100W, Type P	K21650	Plate & Shapes
ASTM	A 709	11B	9	Grade 100, Type Q	—	Plate & Shapes
ASTM	A 709	11B	9	Grade 100W, Type Q	—	Plate & Shapes

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 709	11B	10	Grade 100, Type M	—	Plate & Shapes
ASTM	A 709	11B	10	Grade 100W, Type M	—	Plate & Shapes
ASTM	A 709	11B	11	Grade HPS70W	—	Plate & Shapes
ASTM	A 710	12A	1	Grade A, Class 2	K20747	Structural
ASTM	A 710	12B	1	Grade A, Class 3	K20747	Structural
ASTM	A 710	12C	1	Grade A, Class 1	K20747	Structural
ASTM	A 714	9A	1	Grade V, Type E	K22035	Welded Pipe
ASTM	A 724	1	4	Grade A	K11831	Plate
ASTM	A 724	1	4	Grade B	K12031	Plate
ASTM	A 724	1	4	Grade C	K12037	Plate
ASTM	A 727	1	1	—	K02506	Forging
ASTM	A 731	6	4	S41500	S41500	Seamless & Welded Pipe
ASTM	A 731	7	2	Type 439	S43035	Seamless & Welded Pipe
ASTM	A 731	7	2	Type 18Cr-2Mo	S44400	Seamless & Welded Pipe
ASTM	A 731	10I	1	TPXM-27	S44627	Seamless & Welded Pipe
ASTM	A 731	10I	1	TPXM-33	S44626	Seamless & Welded Pipe
ASTM	A 731	10J	1	S44700	S44700	Seamless & Welded Pipe
ASTM	A 731	10K	1	Grade 26-3-3	S44660	Seamless & Welded Tube
ASTM	A 731	10K	1	Grade 29-4-2	S44800	Seamless & Welded Tube
ASTM	A 734	11A	2	Type A	K21205	Pressure Vessel Plate
ASTM	A 737	1	2	Grade B	K12001	Plate
ASTM	A 737	1	3	Grade C	K12202	Plate
ASTM	A 738	1	2	Grade A	K12447	Plate
ASTM	A 738	1	3	Grade B	K12447	Plate
ASTM	A 738	1	3	Grade C	—	Plate
ASTM	A 739	4	1	Grade B11	K11797	Bar
ASTM	A 739	5A	1	Grade B22	K21390	Bar
ASTM	A 743	6	3	CA-15	J91150	Castings
ASTM	A 743	6	3	CA-15M	J91151	Castings
ASTM	A 743	6	4	CA-6NM	J91540	Castings
ASTM	A 743	6	4	CA-40	J91153	Castings
ASTM	A 743	6	4	CB-6	J91804	Castings
ASTM	A 743	8	1	CC-50	J92615	Castings
ASTM	A 743	8	1	CE-30	J93423	Castings
ASTM	A 743	8	1	CF-3	J92500	Castings
ASTM	A 743	8	1	CF-3M	J92800	Castings
ASTM	A 743	8	1	CF-3MN	J92804	Castings
ASTM	A 743	8	1	CF-8	J92600	Castings
ASTM	A 743	8	1	CF-8C	J92710	Castings
ASTM	A 743	8	1	CF-8M	J92900	Castings
ASTM	A 743	8	1	CF-10SMnN	J92972	Castings
ASTM	A 743	8	1	CF-16F	J92701	Castings
ASTM	A 743	8	1	CG-3M	J92999	Castings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 743	8	1	CG-8M	J93000	Castings
ASTM	A 743	8	1	CG-12	J93001	Castings
ASTM	A 743	8	1	CN-3M	J94652	Castings
ASTM	A 743	8	2	CF-20	J92602	Castings
ASTM	A 743	8	2	CH-10	J93401	Castings
ASTM	A 743	8	2	CH-20	J93402	Castings
ASTM	A 743	8	4	CK-3MCuN	J93254	Castings
ASTM	A 765	1	1	Grade I	K03046	Forging
ASTM	A 765	1	2	Grade II	K03047	Forging
ASTM	A 765	1	3	Grade IV	K03046	Forging
ASTM	A 765	9B	1	Grade III	K32026	Forging
ASTM	A 774	8	1	TP304L	S30403	As-Welded Wrought Fittings
ASTM	A 774	8	1	TP316L	S31603	As-Welded Wrought Fittings
ASTM	A 774	8	1	TP317L	S31703	As-Welded Wrought Fittings
ASTM	A 774	8	1	TP321	S32100	As-Welded Wrought Fittings
ASTM	A 774	8	1	TP347	S34700	As-Welded Wrought Fittings
ASTM	A 778	8	1	TP304L	S30403	Welded Unannealed Tube
ASTM	A 778	8	1	TP316L	S31603	Welded Unannealed Tube
ASTM	A 778	8	1	TP317L	S31703	Welded Unannealed Tube
ASTM	A 778	8	1	TP321	S32100	Welded Unannealed Tube
ASTM	A 778	8	1	TP347	S34700	Welded Unannealed Tube
ASTM	A 782	11B	4	Class 1	—	Pressure Vessel Plate
ASTM	A 782	11B	4	Class 2	—	Pressure Vessel Plate
ASTM	A 782	11B	4	Class 3	—	Pressure Vessel Plate
ASTM	A 789	10H	1	Grade 2304	S32304	Seamless & Welded Tube
ASTM	A 789	10H	1	Grade 2550	S32550	Seamless & Welded Tube
ASTM	A 789	10H	1	Grade 2950	S32950	Seamless & Welded Tube
ASTM	A 789	10H	1	S31803	S31803	Seamless & Welded Tube
ASTM	A 789	10H	1	S32750	S32750	Seamless & Welded Tube
ASTM	A 789	10H	1	S32900	S32900	Seamless & Welded Tube
ASTM	A 789	10H	1	S31200	S31200	Seamless & Welded Tube
ASTM	A 789	10H	1	S31260	S31260	Seamless & Welded Tube
ASTM	A 789	10H	1	S31500	S31500	Seamless & Welded Tube
ASTM	A 789	10H	1	—	S32101	Tubing
ASTM	A 789	10H	1	—	S32205	Tubing
ASTM	A 789	10H	1	—	S32550	Tubing
ASTM	A 789	10H	1	—	S32760	Tubing
ASTM	A 790	10H	1	S31200	S31200	Seamless & Welded Tube
ASTM	A 790	10H	1	S31260	S31260	Seamless & Welded Tube
ASTM	A 790	10H	1	S31500	S31500	Seamless & Welded Tube
ASTM	A 790	10H	1	S31803	S31803	Seamless & Welded Tube
ASTM	A 790	10H	1	—	S32101	Seamless & Welded Pipe
ASTM	A 790	10H	1	—	S32205	Seamless & Welded Pipe

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 790	10H	1	—	S32550	Seamless & Welded Pipe
ASTM	A 790	10H	1	—	S32760	Seamless & Welded Pipe
ASTM	A 790	10H	1	S32304	S32304	Seamless & Welded Tube
ASTM	A 790	10H	1	S32550	S32550	Seamless & Welded Tube
ASTM	A 790	10H	1	S32750	S32750	Seamless & Welded Tube
ASTM	A 790	10H	1	S32900	S32900	Seamless & Welded Tube
ASTM	A 790	10H	1	S32950	S32950	Seamless & Welded Tube
ASTM	A 790	10H	1	S32900	S32900	Tube
ASTM	A 795	1	1	Type E, Grade A	—	Resistance Welded Pipe
ASTM	A 795	1	1	1 Type, Grade B	—	Resistance Welded Pipe
ASTM	A 795	1	1	Type S, Grade A	—	Seamless Pipe
ASTM	A 795	1	1	Type S, Grade B	—	Seamless Pipe
ASTM	A 795	1	1	Type F	—	Furnace-Welded Pipe
ASTM	A 803	7	2	Type 439	S43035	Welded Tube
ASTM	A 803	10K	1	Grade 26-3-3	S44660	Welded Tube
ASTM	A 808	1	1	—	K11852	Structural
ASTM	A 813	8	1	TP304	S30400	Welded Pipe
ASTM	A 813	8	1	TP304H	S30409	Welded Pipe
ASTM	A 813	8	1	TP304L	S30403	Welded Pipe
ASTM	A 813	8	1	TP304LN	S30453	Welded Pipe
ASTM	A 813	8	1	TP304N	S30451	Welded Pipe
ASTM	A 813	8	1	TP316	S31600	Welded Pipe
ASTM	A 813	8	1	TP316H	S31609	Welded Pipe
ASTM	A 813	8	1	TP316L	S31603	Welded Pipe
ASTM	A 813	8	1	TP316LN	S31653	Welded Pipe
ASTM	A 813	8	1	TP316N	S31651	Welded Pipe
ASTM	A 813	8	1	TP317	S31700	Welded Pipe
ASTM	A 813	8	1	TP317L	S31703	Welded Pipe
ASTM	A 813	8	1	TP321	S32100	Welded Pipe
ASTM	A 813	8	1	TP321H	S32109	Welded Pipe
ASTM	A 813	8	1	TP347	S34700	Welded Pipe
ASTM	A 813	8	1	TP347H	S34709	Welded Pipe
ASTM	A 813	8	1	TP348	S34800	Welded Pipe
ASTM	A 813	8	1	TP348H	S34809	Welded Pipe
ASTM	A 813	8	1	TPXM-15	S38100	Welded Pipe
ASTM	A 813	8	3	TPXM-11	S21904	Welded Pipe
ASTM	A 813	8	3	TPXM-19	S20910	Welded Pipe
ASTM	A 813	8	3	TPXM-29	S24000	Welded Pipe
ASTM	A 813	8	4	S31254	S31254	Welded Pipe
ASTM	A 814	8	1	S31254	S31254	Welded Pipe
ASTM	A 814	8	1	TP304	S30400	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP304H	S30409	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP304L	S30403	Cold Worked, Welded Pipe

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 814	8	1	TP304LN	S30453	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP304N	S30451	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP316	S31600	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP316H	S31609	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP316L	S31603	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP316LN	S31653	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP316N	S31651	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP317	S31700	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP317L	S31703	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP321	S32100	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP321H	S32109	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP347	S34700	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP347H	S34709	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP348	S34800	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TP348H	S34809	Cold Worked, Welded Pipe
ASTM	A 814	8	1	TPXM-15	S38100	Cold Worked, Welded Pipe
ASTM	A 814	8	3	TPXM-11	S21904	Cold Worked, Welded Pipe
ASTM	A 814	8	3	TPXM-19	S20910	Cold Worked, Welded Pipe
ASTM	A 814	8	3	TPXM-29	S24000	Cold Worked, Welded Pipe
ASTM	A 815	6	4	S41500	S41500	Pipe Fittings
ASTM	A 815	10H	1	S31803	S31803	Wrought Pipe Fittings
ASTM	A 815	10H	1	S32205	S32205	Wrought Pipe Fittings
ASTM	A 815	10H	1	S32550	S32550	Wrought Pipe Fittings
ASTM	A 815	10H	1	S32760	S32760	Wrought Pipe Fittings
ASTM	A 830	1	1	1006	G10060	Plate
ASTM	A 830	1	1	1008	G10080	Plate
ASTM	A 830	1	1	1009	G10090	Plate
ASTM	A 830	1	1	1010	G10100	Plate
ASTM	A 830	1	1	1012	G10120	Plate
ASTM	A 830	1	1	1015	G10150	Plate
ASTM	A 830	1	1	1016	G10160	Plate
ASTM	A 830	1	1	1017	G10170	Plate
ASTM	A 830	1	1	1018	G10180	Plate
ASTM	A 830	1	1	1019	G10190	Plate
ASTM	A 830	1	1	1020	G10200	Plate
ASTM	A 830	1	1	1021	G10210	Plate
ASTM	A 830	1	1	1022	G10220	Plate
ASTM	A 830	1	1	1023	G10230	Plate
ASTM	A 830	1	1	1025	G10250	Plate
ASTM	A 832	5C	1	Grade 21V	K31830	Plate
ASTM	A 832	5C	1	Grade 22V	K31835	Pressure Vessel Plate
ASTM	A 836	1	1	Class 1	—	Forging
ASTM	A 841	10C	1	TMCP, Class 1	—	Plate

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 844	11A	1	Grade 9% Ni	K81340	Pressure Vessel Plate
ASTM	A 852	11B	11	Grade 70W	K12043	Plate & Shapes
ASTM	A 857	1	1	Grade 25	—	Sheet Piling
ASTM	A 857	1	1	Grade 30	—	Sheet Piling
ASTM	A 857	1	1	Grade 33	—	Sheet Piling
ASTM	A 857	1	1	Grade 36	—	Sheet Piling
ASTM	A 871	3	2	Grade 60	—	Plate & Shapes
ASTM	A 871	3	3	Grade 65	—	Plate & Shapes
ASTM	A 890	10H	1	1A	J93370	Casting
ASTM	A 890	10H	1	1B	J93372	Casting
ASTM	A 890	10H	1	1C	J93373	Casting
ASTM	A 890	10H	1	2A	J93345	Casting
ASTM	A 890	10H	1	3A	J93371	Casting
ASTM	A 890	10H	1	4A	J92205	Casting
ASTM	A 890	10H	1	5A	J93404	Casting
ASTM	A 890	10H	1	6A	J93380	Casting
ASTM	A 913	1	2	Grade 50	—	Structural
ASTM	A 913	1	3	Grade 60	—	Structural Shapes
ASTM	A 913	1	3	Grade 65	—	Structural Shapes
ASTM	A 913	1	4	Grade 70	—	Structural Shapes
ASTM	A 928	10H	1	2205	S32205	Welded Pipe
ASTM	A 928	10H	1	255	S32550	Welded Pipe
ASTM	A 928	10H	1	—	S32760	Welded Pipe
ASTM	A 935	1	1	Grade 45, Class 1	—	Sheet & Strip
ASTM	A 935	1	1	Grade 45, Class 2	—	Sheet & Strip
ASTM	A 935	1	1	Grade 50, Class 1	—	Sheet & Strip
ASTM	A 935	1	1	Grade 50, Class 2	—	Sheet & Strip
ASTM	A 935	1	2	Grade 55, Class 1	—	Sheet & Strip
ASTM	A 935	1	2	Grade 55, Class 2	—	Sheet & Strip
ASTM	A 935	1	2	Grade 60, Class 1	—	Sheet & Strip
ASTM	A 935	1	2	Grade 60, Class 2	—	Sheet & Strip
ASTM	A 935	1	3	Grade 65, Class 1	—	Sheet & Strip
ASTM	A 935	1	3	Grade 65, Class 2	—	Sheet & Strip
ASTM	A 935	1	3	Grade 70, Class 2	—	Sheet & Strip
ASTM	A 935	1	4	Grade 70, Class 1	—	Sheet & Strip
ASTM	A 945	3	1	Grade 50	—	Plate & Shapes
ASTM	A 945	3	2	Grade 65	—	Plate & Shapes
ASTM	A 965	8	1	F304	S30400	Forging
ASTM	A 965	8	1	F304H	S30409	Forging
ASTM	A 965	8	1	F304L	S30403	Forging
ASTM	A 965	8	1	F304LN	S30453	Forging
ASTM	A 965	8	1	F304N	S30451	Forging
ASTM	A 965	8	1	F316	S31600	Forging

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 965	8	1	F316H	S31609	Forging
ASTM	A 965	8	1	F316L	S31603	Forging
ASTM	A 965	8	1	F316LN	S31653	Forging
ASTM	A 965	8	1	F316N	S31651	Forging
ASTM	A 965	8	1	F321	S32100	Forging
ASTM	A 965	8	1	F321H	S32109	Forging
ASTM	A 965	8	1	F347	S34700	Forging
ASTM	A 965	8	1	F347H	S34709	Forging
ASTM	A 965	8	1	F348	S34809	Forging
ASTM	A 965	8	1	F348H	S34800	Forging
ASTM	A 965	8	2	F310	S31000	Forging
ASTM	A 965	8	3	FXM-11	S21904	Forging
ASTM	A 965	8	3	FXM-19	S20910	Forging
ASTM	A 965	8	4	F46	S30600	Forging
ASTM	A 984	1	1	Grade 35	—	Line Pipe
ASTM	A 984	1	2	Grade 45	—	Line Pipe
ASTM	A 984	1	2	Grade 55	—	Line Pipe
ASTM	A 984	1	2	Grade 65	—	Line Pipe
ASTM	A 984	1	4	Grade 85	—	Line Pipe
ASTM	A 992	1	1	—	—	Structural Shapes
ASTM	A 995	10H	1	1B	J93372	Casting
ASTM	A 995	10H	1	2A	J93345	Casting
ASTM	A 995	10H	1	3A	J93371	Casting
ASTM	A 995	10H	1	4A	J92205	Casting
ASTM	A 995	10H	1	5A	J93404	Casting
ASTM	A 995	10H	1	6A	J93380	Casting
ASTM	A 1008	1	1	CS Type B		Sheet
ASTM	A 1008	1	1	DS Type B		Sheet
ASTM	A 1008	1	1	HSLAS Grade 45 cl 1		Sheet & Strip
ASTM	A 1008	1	1	HSLAS Grade 45 cl 2		Sheet & Strip
ASTM	A 1008	1	1	HSLAS Grade 50 cl 1		Sheet & Strip
ASTM	A 1008	1	1	HSLAS Grade 50 cl 2		Sheet & Strip
ASTM	A 1008	1	1	HSLAS Grade 55 cl 2		Sheet & Strip
ASTM	A 1008	1	1	HSLAS-F Grade 50		Sheet & Strip
ASTM	A 1008	1	1	SS Grade 25		Sheet
ASTM	A 1008	1	1	SS Grade 30		Sheet
ASTM	A 1008	1	1	SS Grade 33 type 1, 2		Sheet
ASTM	A 1008	1	1	SS Grade 40 type 1, 2		Sheet
ASTM	A 1008	1	2	HSLAS Grade 55 cl 1		Sheet & Strip
ASTM	A 1008	1	3	SS Grade 80		Sheet
ASTM	A 1008	1	3	HSLAS Grade 70 cl 2		Sheet
ASTM	A 1008	1	4	HSLAS Grade 70 cl 1		Sheet
ASTM	A 1011	1	1	CS Type A, B, C, D		Sheet & Strip

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ASTM	A 1011	1	1	DS Type A, B		Sheet & Strip
ASTM	A 1011	1	1	SS Grade 30		Sheet & Strip
ASTM	A 1011	1	1	SS Grade 33		Sheet & Strip
ASTM	A 1011	1	1	SS Grade 36, Type 1		Sheet & Strip
ASTM	A 1011	1	1	SS Grade 36, Type 2		Sheet & Strip
ASTM	A 1011	1	1	SS Grade 40		Sheet & Strip
ASTM	A 1011	1	1	SS Grade 45		Sheet & Strip
ASTM	A 1011	1	1	SS Grade 50		Sheet & Strip
ASTM	A 1011	1	1	HSLAS Grade 45 cl 1		Sheet & Strip
ASTM	A 1011	1	1	HSLAS Grade 45 cl 2		Sheet & Strip
ASTM	A 1011	1	1	HSLAS Grade 50 cl 1		Sheet & Strip
ASTM	A 1011	1	1	HSLAS Grade 50 cl 2		Sheet & Strip
ASTM	A 1011	1	1	HSLAS-F Grade 50	—	Sheet & Strip
ASTM	A 1011	1	1	HSLAS Grade 55 cl 2		Sheet & Strip
ASTM	A 1011	1	2	HSLAS Grade 55 cl 1		Sheet & Strip
ASTM	A 1011	1	2	HSLAS Grade 60 cl 2		Sheet & Strip
ASTM	A 1011	1	2	SS Grade 55		Sheet & Strip
ASTM	A 1011	1	3	HSLAS Grade 60 cl 1		Sheet & Strip
ASTM	A 1011	1	3	HSLAS Grade 65 cl 1		Sheet & Strip
ASTM	A 1011	1	3	HSLAS Grade 65 cl 2		Sheet & Strip
ASTM	A 1011	1	4	HSLAS Grade 70 cl 1		Sheet & Strip
ASTM	A 1011	1	4	HSLAS Grade 70 cl 2		Sheet & Strip
ASTM	A 1018	1	1	HSLAS Grade 45 cl 1	—	Sheet & Strip
ASTM	A 1018	1	1	HSLAS Grade 45 cl 2	—	Sheet & Strip
ASTM	A 1018	1	1	HSLAS Grade 50 cl 1	—	Sheet & Strip
ASTM	A 1018	1	1	HSLAS Grade 50 cl 2	—	Sheet & Strip
ASTM	A 1018	1	1	HSLAS Grade 55 cl 2	—	Sheet & Strip
ASTM	A 1018	1	1	HSLAS-F Grade 50	—	Sheet & Strip
ASTM	A 1018	1	1	SS Grade 30	—	Sheet & Strip
ASTM	A 1018	1	1	SS Grade 33	—	Sheet & Strip
ASTM	A 1018	1	1	SS Grade 36	—	Sheet & Strip
ASTM	A 1018	1	1	SS Grade 40	—	Sheet & Strip
ASTM	A 1018	1	2	HSLAS Grade 55 cl 1	—	Sheet & Strip
ASTM	A 1018	1	3	HSLAS Grade 60 cl 2	—	Sheet & Strip
ASTM	A 1018	1	3	HSLAS Grade 70 cl 2	—	Sheet & Strip
ASTM	A 1018	1	3	HSLAS-F Grade 60 cl 2	—	Sheet & Strip
ASTM	A 1018	1	3	HSLAS-F Grade 70 cl 2	—	Sheet & Strip
ABS	ABS	1	1	Grade A	K02300	Ordinary Strength Hull Structural Steel
ABS	ABS	1	1	Grade AH32	K11846	High Strength Hull Structural Steel
ABS	ABS	1	1	Grade B	K02102	Ordinary Strength Hull Structural Steel

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
ABS	ABS	1	1	Grade D	K02101	Ordinary Strength Hull Structural Steel
ABS	ABS	1	1	Grade DH32	K11846	High Strength Hull Structural Steel
ABS	ABS	1	1	Grade E	K01801	Ordinary Strength Hull Structural Steel
ABS	ABS	1	1	Grade EH32	K11846	High Strength Hull Structural Steel
ABS	ABS	1	1	Grade FH32	K11846	High Strength Hull Structural Steel
ABS	ABS	1	2	Grade AH36	K11852	High Strength Hull Structural Steel
ABS	ABS	1	2	Grade DH36	K11852	High Strength Hull Structural Steel
ABS	ABS	1	2	Grade EH36	K11852	High Strength Hull Structural Steel
ABS	ABS	1	2	Grade FH36	K11852	High Strength Hull Structural Steel
ABS	ABS	1	3	Grade AH40	K11857	Ordinary Strength Hull Structural Steel
ABS	ABS	1	3	Grade DH40	K11857	Ordinary Strength Hull Structural Steel
ABS	ABS	1	3	Grade EH40	K11857	Ordinary Strength Hull Structural Steel
ABS	ABS	1	3	Grade FH40	K11857	Ordinary Strength Hull Structural Steel
API	2H	1	1	Grade 42	—	Structural
API	2H	1	2	Grade 50	—	Structural
API	5L	1	1	Grade A	—	Pipe
API	5L	1	1	Grade A25, Class I	—	Pipe & Tube
API	5L	1	1	Grade A25, Class II	—	Pipe & Tube
API	5L	1	1	Grade B	—	Pipe
API	5L	1	1	Grade X42	—	Pipe
API	5L	1	2	Grade X52	—	Pipe
API	5L	1	2	Grade X56	—	Pipe
API	5L	1	2	Grade X60	—	Pipe
API	5L	1	3	Grade X65	—	Pipe
API	5L	1	3	Grade X70	—	Pipe
API	5L	1	4	Grade X80	—	Pipe
API	5LS	1	1	Grade X46	—	Pipe
API	2Y	1	1	Grade 42	—	Pipe
API	2Y	1	1	Grade 50	—	Pipe
API	2Y	1	2	Grade 50T	—	Pipe
AS	1548	1	2	5-490	—	Plate
AS	1548	1	1	7-430	—	Plate
AS	1548	1	2	7-460	—	Plate
AS	1548	1	2	7-490	—	Plate
AS/NZS	3678	1	1	200	—	Plate

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
AS/NZS	3678	1	1	250	—	Plate
AS/NZS	3678	1	1	250L15	—	Plate
AS/NZS	3678	1	2	300/300L15	—	Plate
AS/NZS	3678	1	2	350/350L15	—	Plate
AS/NZS	3678	1	2	400/400L15	—	Plate
AS/NZS	3678	3	1	WR350/WR350L0	—	Plate
AS/NZS	3679.1	1	1	250/250L0/250L15	—	Plate
AS/NZS	3679.1	1	2	300/300L0/300L15	—	Plate
AS/NZS	3679.1	1	2	350/350L0/350L15	—	Plate
AS/NZS	3679.1	1	2	400/400L0/400L15	—	Plate
AS/NZS	1594	1	1	HA1	—	Strip
AS/NZS	1594	1	1	HA3	—	Strip
AS/NZS	1594	1	1	HA4N	—	Strip
AS/NZS	1594	1	1	HA200	—	Strip
AS/NZS	1594	1	1	HA250	—	Strip
AS/NZS	1594	1	1	HA250/1	—	Strip
AS/NZS	1594	1	1	HU250	—	Strip
AS/NZS	1594	1	1	HA300	—	Strip
AS/NZS	1594	1	1	HA300/1	—	Strip
AS/NZS	1594	1	1	HU300	—	Strip
AS/NZS	1594	1	1	HU300/1	—	Strip
AS/NZS	1594	1	1	HA350	—	Strip
AS/NZS	1594	1	1	HW350	—	Strip
AS/NZS	1594	1	1	HA400	—	Strip
AS/NZS	1594	1	1	XF300	—	Strip
AS/NZS	1594	1	1	XF400	—	Strip
AS/NZS	1594	1	3	XF500	—	Strip
CSA	G30.18	1A	4	300R	—	Rebar
CSA	G30.18	1A	4	400R	—	Rebar
CSA	G30.18	1A	4	400W	—	Rebar
CSA	G30.18	1A	4	500R	—	Rebar
CSA	G30.18	1A	4	500W	—	Rebar
CSA	G40.20/40.21	1	1	260W	—	Structural
CSA	G40.20/40.21	1	1	260WT	—	Structural
CSA	G40.20/40.21	1	1	300W	—	Structural
CSA	G40.20/40.21	1	1	300WT	—	Structural
CSA	G40.20/40.21	1	2	350A	—	HSLA Steel
CSA	G40.20/40.21	1	2	350AT	—	HSLA Steel
CSA	G40.20/40.21	1	2	350R	—	HSLA Steel
CSA	G40.20/40.21	1	2	350W	—	Structural
CSA	G40.20/40.21	1	2	350WT	—	Structural
CSA	G40.20/40.21	1	2	380W	—	Structural

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
CSA	G40.20/40.21	1	2	380WT	—	Structural
CSA	G40.20/40.21	1	2	400A	—	HSLA Steel
CSA	G40.20/40.21	1	2	400AT	—	HSLA Steel
CSA	G40.20/40.21	1	2	400W	—	HSLA Steel
CSA	G40.20/40.21	1	2	400WT	—	HSLA Steel
CSA	G40.20/40.21	1	3	480W	—	HSLA Steel
CSA	G40.20/40.21	1	3	480WT	—	HSLA Steel
CSA	G40.20/40.21	1	3	480A	—	HSLA Steel
CSA	G40.20/40.21	1	3	480AT	—	HSLA Steel
CSA	G40.20/40.21	1	2	550A	—	Structural Steel
CSA	G40.20/40.21	1	2	550AT	—	Structural Steel
CSA	G40.20/40.21	1	2	550W	—	Structural Steel
CSA	G40.20/40.21	1	2	550WT	—	Structural Steel
CSA	Z245.1	1	1	172	—	Pipe
CSA	Z245.1	1	1	207	—	Pipe
CSA	Z245.1	1	1	241	—	Pipe
CSA	Z245.1	1	1	290	—	Pipe
CSA	Z245.1	1	2	317	—	Pipe
CSA	Z245.1	1	2	359	—	Pipe
CSA	Z245.1	1	2	386	—	Pipe
CSA	Z245.1	1	3	414	—	Pipe
CSA	Z245.1	1	3	448	—	Pipe
CSA	Z245.1	1	3	483	—	Pipe
CSA	Z245.1	1	4	550	—	Pipe
CSA	Z245.11	1	1	207	—	Steel Fittings
CSA	Z245.11	1	1	241	—	Steel Fittings
CSA	Z245.11	1	1	290	—	Steel Fittings
CSA	Z245.11	1	2	317	—	Steel Fittings
CSA	Z245.11	1	2	359	—	Steel Fittings
CSA	Z245.11	1	2	386	—	Steel Fittings
CSA	Z245.11	1	3	414	—	Steel Fittings
CSA	Z245.11	1	3	448	—	Steel Fittings
CSA	Z245.11	1	3	483	—	Steel Fittings
CSA	Z245.11	1	4	550	—	Steel Fittings
CSA	Z245.12	1	1	248	—	Steel Flanges
CSA	Z245.12	1	1	290	—	Steel Flanges
CSA	Z245.12	1	2	317	—	Steel Flanges
CSA	Z245.12	1	2	359	—	Steel Flanges
CSA	Z245.12	1	2	386	—	Steel Flanges
CSA	Z245.12	1	3	414	—	Steel Flanges
CSA	Z245.12	1	3	448	—	Steel Flanges
CSA	Z245.12	1	3	483	—	Steel Flanges

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Ferrous Alloys

Standard	Base Metal Specification	Material Number	Group Number	Type, Grade, or Alloy Designation	UNS Number	Product Form
Steel and Steel Alloys						
MSS	SP75	1	1	WPHY-42	—	Seamless & Welded Fittings
MSS	SP75	1	1	WPHY-46	—	Seamless & Welded Fittings
MSS	SP75	1	1	WPHY-52	—	Seamless & Welded Fittings
MSS	SP75	1	2	WPHY-56	—	Seamless & Welded Fittings
MSS	SP75	1	2	WPHY-60	—	Seamless & Welded Fittings
MSS	SP75	1	2	WPHY-65	—	Seamless & Welded Fittings
MSS	SP75	1	3	WPHY-70	—	Seamless & Welded Fittings

Table D.1
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	A 351	CN7M	45	N08007	Castings
ASTM	A 351	CT15C	45	N08151	Castings
ASTM	A 494	Grade N7M	44	J30007	Castings
ASTM	A 494	Ni-30 Cu (Grade M-35-2)	42	N04020	Castings
ASTM	A 494	Grade CY-40	43	N06040	Castings
ASTM	A 494	Ni-30 Cu-Si-Cb (Grade M-30-C)	42	N24130	Castings
ASTM	A 494	Ni-30 Cu (Grade M-35-1)	42	N24135	Castings
ASTM	A 494	Grade CX2MW	43	N26022	Castings
ASTM	A 494	Grade CW2M	43	N26455	Castings
ASTM	A 494	Grade CW-6 MC	43	N26625	Castings
ASTM	A 494	N-7M	44	N30007	Castings
ASTM	A 494	Grade CW-6M	43	N30107	Castings
ASTM	B 21	Alloy A Naval Brass O60	32	C46400	Rod, Bar & Shapes
ASTM	B 26	208.0 (F)	26	A02080	Sand Castings
ASTM	B 26	222.0 (T61)	26	A02220	Sand Castings
ASTM	B 26	319.0 (F, T5, T6)	26	A03190	Sand Castings
ASTM	B 26	328.0 (F, T6)	26	A03280	Sand Castings
ASTM	B 26	356.0 (T51, T6, T7, T71)	26	A03560	Sand Castings
ASTM	B 26	443.0 (F)	26	A04430	Sand Castings
ASTM	B 26	512.0 (F)	26	A05120	Sand Castings
ASTM	B 26	514.0 (F)	26	A05140	Sand Castings
ASTM	B 26	535.0 (F)	26	A05350	Sand Castings
ASTM	B 26	705.0 (T5)	26	A07050	Sand Castings
ASTM	B 26	710.0 (T5)	26	A07100	Sand Castings
ASTM	B 26	A356.0 (T6)	26	A13560	Sand Castings
ASTM	B 26	B443.0 (F)	26	A24430	Sand Castings
ASTM	B 42	Deoxidized High P Cu (DHP)	31	C12200	Seamless Pipe
ASTM	B 42	Deoxidized Low P Cu (DLP)	31	C12000	Seamless Pipe
ASTM	B 42	Oxygen-Free Cu (OF)	31	C10200	Seamless Pipe
ASTM	B 42	Oxygen-Free Cu (OFLP)	31	C10800	Seamless Pipe
ASTM	B 42	Oxygen-Free Cu (OFXLP)	31	C10300	Seamless Pipe
ASTM	B 43	Red Brass, 85%	32	C23000	Seamless Pipe
ASTM	B 68	Deoxidized High P Cu (DHP)	31	C12200	Seamless Tube
ASTM	B 68	Deoxidized Low P Cu (DLP)	31	C12000	Seamless Tube
ASTM	B 68	Oxygen-Free Cu (OF)	31	C10200	Seamless Tube
ASTM	B 68	Oxygen-Free Cu (OFLP)	31	C10800	Seamless Tube
ASTM	B 68	Oxygen-Free Cu (OFXLP)	31	C10300	Seamless Tube
ASTM	B 75	Deoxidized High P Cu (DHP)	31	C12200	Seamless Tube
ASTM	B 75	Deoxidized Low P Cu (DLP)	31	C12000	Seamless Tube
ASTM	B 75	Oxygen-Free Cu (DPA)	31	C14200	Seamless Tube
ASTM	B 75	Oxygen-Free Cu (OF)	31	C10200	Seamless Tube
ASTM	B 75	Oxygen-Free Cu (OFE)	31	C10100	Seamless Tube
ASTM	B 75	Oxygen-Free Cu (OFLP)	31	C10800	Seamless Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 75	Oxygen-Free Cu (OFXLP)	31	C10300	Seamless Tube
ASTM	B 80	AZ91C (-F)	83	M11914	Sand Castings
ASTM	B 80	AZ92A (-F)	83	M11920	Sand Castings
ASTM	B 80	K1A (-F)	83	M18010	Sand Castings
ASTM	B 88	Oxygen Free Cu (DLP)	31	C12000	Seamless Tube
ASTM	B 88	Oxygen Free Cu (DHP)	31	C12200	Seamless Tube
ASTM	B 88	Oxygen Free Cu (OF)	31	C10200	Seamless Tube
ASTM	B 88	Oxygen-Free Cu (OFXLP)	31	C10300	Seamless Tube
ASTM	B 90	AZ31B (-O, H24, H26)	81	M11311	Plate & Sheet
ASTM	B 90	AZ31C (-O, H24, H26)	81	M11312	Plate & Sheet
ASTM	B 90	HK31A (-O, H24)	81	M13310	Plate & Sheet
ASTM	B 90	ZE10A (-O)	81	M16100	Sheet
ASTM	B 90	ZE10A (-O)	81	M16100	Plate
ASTM	B 91	AZ31B (-F)	81	M11311	Forgings
ASTM	B 91	AZ61A (-F)	81	M11610	Forgings
ASTM	B 96	High Si Bronze A	33	C65500	Plate, Sheet, Strip, Rolled Bar
ASTM	B 96	Low Si Bronze B	33	C65100	Plate, Sheet, Strip, Rolled Bar
ASTM	B 96	Silicon Bronze	33	C65400	Plate, Sheet, Strip, Rolled Bar
ASTM	B 98	High Si Bronze A	33	C65500	Rod, Bars & Shapes
ASTM	B 98	Low Si Bronze B	33	C65100	Rod, Bars & Shapes
ASTM	B 98	Silicon Bronze	33	C66100	Rod, Bars & Shapes
ASTM	B 107	AZ31B (-F)	81	M11311	Extruded Bars, Rods, Profiles, Tubes, Wires
ASTM	B 107	AZ31C (-F)	81	M11312	Extruded Bars, Rods, Profiles, Tubes, Wires
ASTM	B 107	AZ61A (-F)	81	M11610	Extruded Bars, Rods, Profiles, Tubes, Wires
ASTM	B 107	M1A (-F)	81	M15100	Extruded Bars, Rods, Profiles, Tubes, Wires
ASTM	B 108	308.0 (F)	26	A03080	Permanent Mold Casting
ASTM	B 108	319.0 (F, T6)	26	A03190	Permanent Mold Casting
ASTM	B 108	333.0 (T5, T6, T7)	26	A03330	Permanent Mold Casting
ASTM	B 108	356.0 (F, T51, T6, T7, T71)	26	A03560	Permanent Mold Casting
ASTM	B 108	443.0 (F)	26	A04430	Permanent Mold Casting
ASTM	B 108	513.0 (F)	26	A05130	Permanent Mold Casting
ASTM	B 108	535.0 (F)	26	A05350	Permanent Mold Casting
ASTM	B 108	A356.0 (T61)	26	A13560	Permanent Mold Casting
ASTM	B 108	A444.0 (T4)	26	A14440	Permanent Mold Casting
ASTM	B 108	B443.0 (F)	26	A24430	Permanent Mold Casting
ASTM	B 111	70-30 Cu-Ni	34	C71500	Seamless Tube & Ferrule Stock
ASTM	B 111	80-20 Cu-Ni	34	C71000	Seamless Tube & Ferrule Stock
ASTM	B 111	85-15 Cu-Ni	34	C72200	Seamless Tube & Ferrule Stock
ASTM	B 111	90-10 Cu-Ni	34	C70600	Seamless Tube & Ferrule Stock
ASTM	B 111	95-5 Cu-Ni	34	C70400	Seamless Tube & Ferrule Stock
ASTM	B 111	98.5 min Cu	31	C19200	Seamless Tube & Ferrule Stock
ASTM	B 111	Admiralty, A	32	C44300	Seamless Tube & Ferrule Stock
ASTM	B 111	Admiralty, B	32	C44400	Seamless Tube & Ferrule Stock
ASTM	B 111	Admiralty, C	32	C44500	Seamless Tube & Ferrule Stock

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 111	Aluminum Brass B	32	C68700	Seamless Tube & Ferrule Stock
ASTM	B 111	Aluminum Bronze	35	C60800	Seamless Tube & Ferrule Stock
ASTM	B 111	Aluminum Bronze	35	C61300	Seamless Tube & Ferrule Stock
ASTM	B 111	Aluminum Bronze D	35	C61400	Seamless Tube & Ferrule Stock
ASTM	B 111	Cu-Ni-Fe-Mn	34	C71640	Seamless Tube & Ferrule Stock
ASTM	B 111	Muntz Metal	32	C28000	Seamless Tube & Ferrule Stock
ASTM	B 111	Oxygen-Free Cu (DHP)	31	C12200	Seamless Tube & Ferrule Stock
ASTM	B 111	Oxygen-Free Cu (DLP)	31	C12000	Seamless Tube & Ferrule Stock
ASTM	B 111	Oxygen-Free Cu (DPA)	31	C14200	Seamless Tube & Ferrule Stock
ASTM	B 111	Oxygen-Free Cu (OF)	31	C10200	Seamless Tube & Ferrule Stock
ASTM	B 111	Oxygen-Free Cu (OFE)	31	C10100	Seamless Tube & Ferrule Stock
ASTM	B 111	Oxygen-Free Cu (OFLP)	31	C10800	Seamless Tube & Ferrule Stock
ASTM	B 111	Oxygen-Free Cu (OFXLP)	31	C10300	Seamless Tube & Ferrule Stock
ASTM	B 111	Red Brass, 85%	32	C23000	Seamless Tube & Ferrule Stock
ASTM	B 127	Ni-Cu (Alloy 400)	42	N04400	Sheet, Plate, Strip
ASTM	B 135	Commercial Bronze, 90%	32	C22000	Seamless Tube
ASTM	B 135	Red Brass, 85%	32	C23000	Seamless Tube
ASTM	B 148	Aluminum Bronze	35	C95410	Sand Castings
ASTM	B 148	Grade A Al-Bronze	35	C95200	Sand Castings
ASTM	B 148	Grade B Al-Bronze	35	C95300	Sand Castings
ASTM	B 148	Grade C Al-Bronze	35	C95400	Sand Castings
ASTM	B 148	Grade D Ni-Al Bronze	35	C95500	Sand Castings
ASTM	B 148	Grade E, Si-Al Bronze	35	C95600	Sand Castings
ASTM	B 148	Grade F, Mn-Ni-Al Bronze	35	C95700	Sand Castings
ASTM	B 148	Ni-Al Bronze	35	C95800	Sand Castings
ASTM	B 150	Aluminum Bronze	35	C61300	Rod & Bar
ASTM	B 150	Aluminum Bronze	35	C61900	Round Rod & Shapes
ASTM	B 150	Aluminum Bronze	35	C62300	Rod, Bar, Shapes
ASTM	B 150	Aluminum Bronze	35	C62400	Rod, Bar, Shapes
ASTM	B 150	Aluminum Bronze	35	C63000	Rod, Bar, Shapes
ASTM	B 150	Aluminum Bronze	35	C63020	Rod & Bar
ASTM	B 150	Aluminum Bronze	35	C63200	Rod, Bar, Shapes
ASTM	B 150	Aluminum Bronze	35	C64200	Rod, Bar, Shapes
ASTM	B 150	Aluminum Bronze D	35	C61400	Round Rod
ASTM	B 151	70-30 Cu-Ni	34	C71500	Rod, Bar, Shapes
ASTM	B 151	90-10 Cu-Ni	34	C70600	Rod, Bar, Shapes
ASTM	B 152	Oxygen-Free Cu (DLP)	31	C12000	Plate, Sheet, Strip, Rolled Bar
ASTM	B 152	Oxygen-Free Cu (DHP)	31	C12200	Plate, Sheet, Strip, Rolled Bar
ASTM	B 152	Oxygen-Free Cu (DPA)	31	C14200	Plate, Sheet, Strip, Rolled Bar
ASTM	B 152	Oxygen-Free Cu (DPS)	31	C12300	Plate, Sheet, Strip, Rolled Bar
ASTM	B 152	Oxygen-Free Cu (OF)	31	C10200	Plate, Sheet, Strip, Rolled Bar
ASTM	B 152	Oxygen-Free Cu (OFE)	31	C10100	Plate, Sheet, Strip, Rolled Bar
ASTM	B 152	Oxygen-Free Cu (OFLP)	31	C10800	Plate, Sheet, Strip, Rolled Bar
ASTM	B 152	Oxygen-Free Cu (OFS)	31	C10400	Plate, Sheet, Strip, Rolled Bar

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 152	Oxygen-Free Cu (OFS)	31	C10500	Plate, Sheet, Strip, Rolled Bar
ASTM	B 152	Oxygen-Free Cu (OFS)	31	C10700	Plate, Sheet, Strip, Rolled Bar
ASTM	B 152	Oxygen-Free Cu (OFXLP)	31	C10300	Plate, Sheet, Strip, Rolled Bar
ASTM	B 152	Sn Bearing Tellurium Cu	31	C14420	Plate, Sheet, Strip, Rolled Bar
ASTM	B 160	99.0 min Ni (Alloy 200)	41	N02200	Rod & Bar
ASTM	B 160	Lo C-99 min Ni (Alloy 201)	41	N02201	Rod, Bar, Shapes
ASTM	B 161	99.0 min Ni (Alloy 200)	41	N02200	Seamless Pipe & Tube
ASTM	B 161	Lo C-99 min Ni (Alloy 201)	41	N02201	Seamless Pipe & Tube
ASTM	B 162	99.0 min Ni (Alloy 200)	41	N02200	Sheet, Strip & Plate
ASTM	B 162	Lo C-99 min Ni (Alloy 201)	41	N02201	Sheet, Strip & Plate
ASTM	B 163	99.0 min Ni (Alloy 200)	41	N02200	Seamless Tube
ASTM	B 163	Lo C-99 min Ni (Alloy 201)	41	N02201	Seamless Tube
ASTM	B 163	Ni-Fe-Cr (Alloy 800)	45	N08800	Seamless Tube
ASTM	B 163	Ni-Fe-Cr (Alloy 801)	45	N08801	Seamless Tube
ASTM	B 163	Ni-Fe-Cr (Alloy 800H)	45	N08810	Seamless Tube
ASTM	B 163	Ni-Fe-Cr (Alloy 800HT)	45	N08811	Seamless Tube
ASTM	B 163	Ni-Cr-Fe (Alloy 6025HT)	43	N06025	Seamless Tube
ASTM	B 163	Ni-Cr-Fe (Alloy 600)	43	N06600	Seamless Tube
ASTM	B 163	Ni-Cr-Fe (Alloy 690)	43	N06690	Seamless Tube
ASTM	B 163	Ni-Cr-Fe-Si (Alloy 45)	46	N06045	Seamless Tube
ASTM	B 163	Ni-Cu (30) (Alloy 400)	42	N04400	Seamless Tube
ASTM	B 163	Ni-Fe-Cr (Alloy 825)	45	N08825	Seamless Tube
ASTM	B 164	Ni-Cu (30) (Alloy 400)	42	N04400	Rod, Bar & Wire
ASTM	B 164	Ni-Cu (30) (Alloy R 405)	42	N04405	Rod, Bar & Wire
ASTM	B 165	Ni-Cu (30) (Alloy 400)	42	N04400	Seamless Pipe & Tube
ASTM	B 166	Ni-Cr-Co-Mo (Alloy 617)	43	N06617	Rod & Bar
ASTM	B 166	Ni-Cr-Fe (Alloy 6025 HT)	43	N06025	Rod & Bar
ASTM	B 166	Ni-Cr-Fe (Alloy 600)	43	N06600	Rod & Bar
ASTM	B 166	Ni-Cr-Fe (Alloy 601)	43	N06601	Rod & Bar
ASTM	B 166	Ni-Cr-Fe (Alloy 690)	43	N06690	Rod & Bar
ASTM	B 166	Ni-Cr-Fe-Si (Alloy 45)	46	N06045	Rod & Bar
ASTM	B 167	Ni-Cr-Fe (Alloy 6025HT)	43	N06025	Seamless Pipe & Tube
ASTM	B 167	Ni-Cr-Fe (Alloy 600)	43	N06600	Seamless Pipe & Tube
ASTM	B 167	Ni-Cr-Fe (Alloy 601)	43	N06601	Seamless Pipe & Tube
ASTM	B 167	Ni-Cr-Fe (Alloy 690)	43	N06690	Seamless Pipe & Tube
ASTM	B 167	Ni-Cr-Fe (Alloy 45)	45	N06045	Seamless Pipe & Tube
ASTM	B 168	Ni-Cr-Co-Mo (Alloy 617)	43	N06617	Plate, Sheet & Strip
ASTM	B 168	Ni-Cr-Fe (Alloy 6025 HT)	43	N06025	Plate, Sheet & Strip
ASTM	B 168	Ni-Cr-Fe (Alloy 600)	43	N06600	Plate, Sheet & Strip
ASTM	B 168	Ni-Cr-Fe (Alloy 601)	43	N06601	Plate, Sheet & Strip
ASTM	B 168	Ni-Cr-Fe (Alloy 690)	43	N06690	Plate, Sheet & Strip
ASTM	B 168	Ni-Cr-Fe (Alloy 45)	46	N06045	Plate, Sheet & Strip
ASTM	B 169	Aluminum Bronze	35	C61300	Sheet, Strip & Rolled Bar
ASTM	B 169	Aluminum Bronze D	35	C61400	Sheet, Strip & Rolled Bar

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 170	Oxygen-Free Electronic Cu (OF)	31	C10200	Refinery Shapes
ASTM	B 170	Oxygen-Free Electronic Cu (OFE)	31	C10100	Refinery Shapes
ASTM	B 171	70-30 Cu-Ni	34	C71500	Plate & Sheet
ASTM	B 171	85-15 Cu-Ni	34	C72200	Plate & Sheet
ASTM	B 171	90-10 Cu-Ni	34	C70600	Plate & Sheet
ASTM	B 171	Admiralty, A	32	C44300	Plate & Sheet
ASTM	B 171	Admiralty, B	32	C44400	Plate & Sheet
ASTM	B 171	Admiralty, C	32	C44500	Plate & Sheet
ASTM	B 171	Aluminum Bronze	35	C61300	Plate & Sheet
ASTM	B 171	Aluminum Bronze	35	C63000	Plate & Sheet
ASTM	B 171	Aluminum Bronze	35	C63200	Plate & Sheet
ASTM	B 171	Aluminum Bronze D	35	C61400	Plate & Sheet
ASTM	B 171	Leaded Muntz Metal	32	C36500	Plate & Sheet
ASTM	B 171	Naval Brass	32	C46400	Plate & Sheet
ASTM	B 171	Naval Brass, Arsenical	32	C46500	Plate & Sheet
ASTM	B 187	Controlled Oxygen Cu	31	C10940	Rod, Bar & Rolled Shapes
ASTM	B 187	Oxygen-Free Cu (OF)	31	C10200	Rod, Bar & Rolled Shapes
ASTM	B 187	Oxygen-Free Cu (OFE)	31	C10100	Rod, Bar & Rolled Shapes
ASTM	B 187	Oxygen-Free Cu (OFXLP)	31	C10300	Rod, Bar & Rolled Shapes
ASTM	B 187	Oxygen-Free Cu with Ag (OFS)	31	C10400	Rod, Bar & Rolled Shapes
ASTM	B 187	Oxygen-Free Cu with Ag (OFS)	31	C10700	Rod, Bar & Rolled Shapes
ASTM	B 187	Sn Bearing Tellurium Cu	31	C14420	Rod, Bar & Rolled Shapes
ASTM	B 199	AM100A (-F)	83	M10100	Permanent Mold Casting
ASTM	B 199	AZ91C (-F)	83	M11914	Permanent Mold Casting
ASTM	B 199	AZ92A (-F)	83	M11920	Permanent Mold Casting
ASTM	B 209	1060	21	A91060	Plate & Sheet
ASTM	B 209	1100	21	A91100	Plate & Sheet
ASTM	B 209	2014 (T3, T4, T45, T6, T65)	24	A92014	Plate & Sheet
ASTM	B 209	2219 (T31, T37, T62, T81, T87)	24	A92219	Plate & Sheet
ASTM	B 209	3003	21	A93003	Plate & Sheet
ASTM	B 209	3004	22	A93004	Plate & Sheet
ASTM	B 209	3005	21	A93005	Sheet
ASTM	B 209	3105	21	A93105	Sheet
ASTM	B 209	5005	21	A95005	Plate & Sheet
ASTM	B 209	5010	21	A95010	Sheet
ASTM	B 209	5050	21	A95050	Plate & Sheet
ASTM	B 209	5052	22	A95052	Plate & Sheet
ASTM	B 209	5083	25	A95083	Plate & Sheet
ASTM	B 209	5086	25	A95086	Plate & Sheet
ASTM	B 209	5154	22	A95154	Plate & Sheet
ASTM	B 209	5252	22	A95252	Plate & Sheet
ASTM	B 209	5254	22	A95254	Plate & Sheet
ASTM	B 209	5454	22	A95454	Plate & Sheet
ASTM	B 209	5456	25	A95456	Plate & Sheet

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 209	5457	21	A95457	Sheet
ASTM	B 209	5652	22	A95652	Plate & Sheet
ASTM	B 209	6061 (T4, T6, T651)	23	A96061	Plate & Sheet
ASTM	B 209	Alclad 2014 (T3, T4, T45, T6, T65)	24	A82014	Plate & Sheet
ASTM	B 209	Alclad 2219 (T31, T37, T62, T81, T87)	24	A82219	Plate & Sheet
ASTM	B 209	Alclad 3003	21	A83003	Plate & Sheet
ASTM	B 209	Alclad 3004	22	A83004	Plate & Sheet
ASTM	B 209	Alclad 6061 (T4, T6, T62, T651)	23	A86061	Plate & Sheet
ASTM	B 210	3303	21	A93303	Drawn Seamless Tube
ASTM	B 210	1060	21	A91060	Drawn Seamless Tube
ASTM	B 210	1100	21	A91100	Drawn Seamless Tube
ASTM	B 210	2014 (T4, T6)	24	A92014	Drawn Seamless Tube
ASTM	B 210	3003	21	A93003	Drawn Seamless Tube
ASTM	B 210	3102	21	A93102	Drawn Seamless Tube
ASTM	B 210	5005	21	A95005	Drawn Seamless Tube
ASTM	B 210	5050	21	A95050	Drawn Seamless Tube
ASTM	B 210	5052	22	A95052	Drawn Seamless Tube
ASTM	B 210	5083	25	A95083	Drawn Seamless Tube
ASTM	B 210	5086	25	A95086	Drawn Seamless Tube
ASTM	B 210	5154	22	A95154	Drawn Seamless Tube
ASTM	B 210	5456	25	A95456	Drawn Seamless Tube
ASTM	B 210	6061 (T4, T6)	23	A96061	Drawn Seamless Tube
ASTM	B 210	6063 (T4, T6, T62, T83)	23	A96063	Drawn Seamless Tube
ASTM	B 210	Alclad 3003	21	A83003	Drawn Seamless Tube
ASTM	B 210	Alclad 3102	21	A83102	Drawn Seamless Tube
ASTM	B 210	Alclad 3303	21	A83303	Drawn Seamless Tube
ASTM	B 211	1060	21	A91060	Bar, Rod & Wire (Cold Finished)
ASTM	B 211	1100	21	A91100	Bar, Rod & Wire (Cold Finished)
ASTM	B 211	2014 (T4, T6)	24	A92014	Bar, Rod & Wire
ASTM	B 211	2219 (T851)	24	A92219	Bar, Rod & Wire
ASTM	B 211	3003	21	A93003	Bar, Rod & Wire
ASTM	B 211	5052	22	A95052	Bar, Rod & Wire (Cold Finished)
ASTM	B 211	5056	25	A95056	Bar, Rod & Wire (Cold Finished)
ASTM	B 211	5154	22	A95154	Bar, Rod & Wire (Cold Finished)
ASTM	B 211	6061 (T4, T6, T62, T651)	23	A96061	Bar, Rod & Wire
ASTM	B 211	Alclad 5056	25	A85056	Bar, Rod & Wire (Cold Finished)
ASTM	B 221	1060	21	A91060	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	1100	21	A91100	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	2014 (T4, T45, T6, T65)	24	A92014	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	2219 (T31, T35, T62, T81, T85)	24	A92219	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	3003	21	A93003	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	3004	22	A93004	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	3102	21	A93102	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	5052	22	A95052	Ext. Bar, Rod, Wire, Shapes & Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 221	5083	25	A95083	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	5086	25	A95086	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	5154	22	A95154	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	5454	22	A95454	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	5456	25	A95456	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	6005 (T1, T5)	23	A96005	Ext. Rod, Bar, Shapes & Tube
ASTM	B 221	6005A (T1, T5)	23	A96005	Ext. Rod, Bar, Shapes & Tube
ASTM	B 221	6061 (T1, T4, T5, T6, T651)	23	A96061	Ext. Rod, Bar, Shapes & Tube
ASTM	B 221	6063 (T1, T4, T5, T6)	23	A96063	Ext. Rod, Bar, Shapes & Tube
ASTM	B 221	6105 (T1, T5)	23	A96105	Ext. Rod, Bar, Shapes & Tube
ASTM	B 221	6162 (T5, T55, T6, T65)	23	A96162	Ext. Rod, Bar, Shapes & Tube
ASTM	B 221	6351 (T1, T4, T5, T6)	23	A96351	Ext. Rod, Bar, Shapes & Tube
ASTM	B 221	6463 (T1, T5, T6)	23	A96463	Ext. Rod, Bar, Shapes & Tube
ASTM	B 221	7005 (T53)	27*	A97005	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 221	Alclad 3003	21	A83003	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 230	1350	21	A91350	Wire (Electrical)
ASTM	B 234	1060	21	A91060	Drawn Seamless Tube
ASTM	B 234	3003	21	A93003	Drawn Seamless Tube
ASTM	B 234	5052	22	A95052	Drawn Seamless Tubes
ASTM	B 234	5454	22	A95454	Drawn Seamless Tubes
ASTM	B 234	6061 (T4, T6)	23	A96061	Drawn Seamless Tube
ASTM	B 234	Alclad 3003	21	A83003	Drawn Seamless Tube
ASTM	B 236	1350	21	A91350	Bars (Electrical)
ASTM	B 241	6063 (T1, T4, T42, T5, T52, T6, T62)	23	A96063	Extruded Seamless Pipe & Tube
ASTM	B 241	1060	21	A91060	Seamless Pipe & Ext. Tube
ASTM	B 241	1100	21	A91100	Seamless Pipe & Ext. Tube
ASTM	B 241	2014 (T4, T45, T6, T62, T65)	24	A92014	Extruded Seamless Pipe & Tube
ASTM	B 241	2219 (T31, T35, T62, T81, T85)	24	A92219	Extruded Seamless Pipe & Tube
ASTM	B 241	3003	21	A93003	Seamless Pipe & Ext. Tube
ASTM	B 241	5052	22	A95052	Extruded Seamless Pipe & Tube
ASTM	B 241	5083	25	A95083	Ext. Pipe & Tube
ASTM	B 241	5086	25	A95086	Ext. Pipe & Tube
ASTM	B 241	5454	22	A95454	Extruded Seamless Pipe & Tube
ASTM	B 241	5456	25	A95456	Ext. Pipe & Tube
ASTM	B 241	6061 (T1, T4, T42, T51, T6, T62)	23	A96061	Extruded Seamless Pipe & Tube
ASTM	B 241	6162 (T5, T55, T6, T65)	23	A96162	Extruded Seamless Pipe & Tube
ASTM	B 241	6351 (T4, T6)	23	A96351	Extruded Seamless Pipe & Tube
ASTM	B 241	Alclad 3003	21	A83003	Seamless Pipe & Ext. Tube
ASTM	B 247	1100	21	A91100	Die, Hand & Rolled Ring Forgings
ASTM	B 247	2014 (T4, T6)	24	A92014	Die Forgings
ASTM	B 247	2014 (T6, T652)	24	A92014	H& Forgings
ASTM	B 247	2219 (T6)	24	A92219	Die Forgings
ASTM	B 247	2219 (T6, T852)	24	A92219	H& Forgings
ASTM	B 247	3003	21	A93003	Die, Hand & Rolled Ring Forgings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 247	5083	25	A95083	H& Forgings
ASTM	B 247	5083	25	A95083	Die Forgings
ASTM	B 247	6061 (T6)	23	A96061	Die Forgings
ASTM	B 247	6061 (T6, T652)	23	A96061	Rolled Ring Forgings
ASTM	B 247	6061 (T6, T652)	23	A96061	H& Forgings
ASTM	B 247	6151 (T6)	23	A96151	Die Forgings
ASTM	B 247	6151 (T6, T652)	23	A96151	Rolled Ring Forgings
ASTM	B 265	Grade 1	51	R50250	Plate, Sheet & Strip
ASTM	B 265	Grade 2	51	R50400	Plate, Sheet & Strip
ASTM	B 265	Grade 3	52	R50550	Plate, Sheet & Strip
ASTM	B 265	Grade 4	53	R50700	Plate, Sheet & Strip
ASTM	B 265	Grade 5	54	R56400	Plate, Sheet & Strip
ASTM	B 265	Grade 6	54	R54520	Plate, Sheet & Strip
ASTM	B 265	Grade 7	51	R52400	Plate, Sheet & Strip
ASTM	B 265	Grade 9	53	R56320	Plate, Sheet & Strip
ASTM	B 265	Grade 11	51	R52250	Plate, Sheet & Strip
ASTM	B 265	Grade 12	52	R53400	Plate, Sheet & Strip
ASTM	B 265	Grade 13	51	R53413	Plate, Sheet & Strip
ASTM	B 265	Grade 14	52	R53414	Plate, Sheet & Strip
ASTM	B 265	Grade 15	52	R53415	Plate, Sheet & Strip
ASTM	B 265	Grade 16	51	R52402	Plate, Sheet & Strip
ASTM	B 265	Grade 17	51	R52252	Plate, Sheet & Strip
ASTM	B 265	Grade 18	53	R56322	Plate, Sheet & Strip
ASTM	B 265	Grade 19	53	R58640	Plate, Sheet & Strip
ASTM	B 265	Grade 20	53	R58645	Plate, Sheet & Strip
ASTM	B 265	Grade 21	53	R58210	Plate, Sheet & Strip
ASTM	B 265	Grade 24	54	R56405	Plate, Sheet & Strip
ASTM	B 265	Grade 25	54	R56403	Plate, Sheet & Strip
ASTM	B 265	Grade 26	51	—	Plate, Sheet & Strip
ASTM	B 265	Grade 27	51	—	Plate, Sheet & Strip
ASTM	B 265	Grade 28	53	R56323	Plate, Sheet & Strip
ASTM	B 265	Grade 29	54	R56404	Plate, Sheet & Strip
ASTM	B 265	Grade 30	51	—	Plate, Sheet & Strip
ASTM	B 265	Grade 31	52	—	Plate, Sheet & Strip
ASTM	B 265	Grade 32	53	—	Plate, Sheet & Strip
ASTM	B 265	Grade 33	51	—	Plate, Sheet & Strip
ASTM	B 265	Grade 34	52	—	Plate, Sheet & Strip
ASTM	B 265	Grade 35	54	—	Plate, Sheet & Strip
ASTM	B 271	Aluminum Bronze	35	C95410	Centrifugal Castings
ASTM	B 271	Grade A Al-Bronze	35	C95200	Centrifugal Castings
ASTM	B 271	Grade B Al-Bronze	35	C95300	Centrifugal Castings
ASTM	B 271	Grade C Al-Bronze	35	C95400	Centrifugal Castings
ASTM	B 271	Grade D Ni-Al Bronze	35	C95500	Centrifugal Castings
ASTM	B 280	Deoxidized Cu (DHP)	31	C12200	Seamless Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 280	Deoxidized Cu (DLP)	31	C12000	Seamless Tube
ASTM	B 280	Oxygen-free Cu (OF)	31	C10200	Seamless Tube
ASTM	B 283	Al-Si Bronze	35	C64200	Die Forgings
ASTM	B 283	High Si Bronze A	33	C65500	Die Forgings
ASTM	B 308	6061 (T6)	23	A96061	Standard Structural Shapes
ASTM	B 313	1100	21	A91100	Welded Tube
ASTM	B 313	3003	21	A93003	Welded Tube
ASTM	B 313	3004	22	A93004	Formed Sheet & Seam Welded Tube
ASTM	B 313	3005	21	A93005	Welded Tube
ASTM	B 313	5050	21	A95050	Welded Tube
ASTM	B 313	5052	22	A95052	Formed Sheet & Seam Welded Tube
ASTM	B 313	5086	25	A95086	Formed Sheet & Seam Welded Tube
ASTM	B 313	5154	22	A95154	Formed Sheet & Seam Welded Tube
ASTM	B 313	6061 (T4, T6)	23	A96061	Formed Sheet & Seam Welded Tube
ASTM	B 313	Alclad 3004	22	A83004	Formed Sheet & Seam Welded Tube
ASTM	B 315	Aluminum Bronze	35	C61300	Seamless Pipe
ASTM	B 315	Aluminum Bronze D	35	C61400	Seamless Pipe
ASTM	B 315	High Si Bronze A	33	C65500	Pipe
ASTM	B 315	High Si Bronze A	33	C65500	Tube
ASTM	B 315	Low Si Bronze B	33	C65100	Pipe
ASTM	B 315	Low Si Bronze B	33	C65100	Tube
ASTM	B 317	6101 (T6, T61, T64, T65)	23	A96101	Ext. Bar, Rod, Wire, Shapes & Tube
ASTM	B 324	1350	21	A91350	Rectangular & Square Wire (Electrical)
ASTM	B 333	Ni-Mo-Fe (Alloy B)	44	N10001	Plate, Sheet & Strip
ASTM	B 333	Alloy B-10	44	N10624	Plate, Sheet & Strip
ASTM	B 333	Ni-Mo-Fe (Alloy B-4)	44	N10629	Plate, Sheet & Strip
ASTM	B 333	Ni-Mo (Alloy B-2)	44	N10665	Plate, Sheet & Strip
ASTM	B 333	Ni-Mo-Cr-Fe (Alloy B-3)	44	N10675	Plate, Sheet & Strip
ASTM	B 335	Ni-Mo-Fe (Alloy B)	44	N10001	Rod
ASTM	B 335	Alloy B-10	44	N10624	Rod
ASTM	B 335	Ni-Mo-Fe (Alloy B-4)	44	N10629	Rod
ASTM	B 335	Ni-Mo (Alloy B-2)	44	N10665	Rod
ASTM	B 335	Ni-Mo-Cr-Fe (Alloy B-3)	44	N10675	Rod
ASTM	B 337	Grade 1	51	R50250	Seamless & Welded Pipe
ASTM	B 337	Grade 2	51	R50400	Seamless & Welded Pipe
ASTM	B 337	Grade 3	52	R50550	Seamless & Welded Pipe
ASTM	B 337	Grade 7	51	R52400	Seamless & Welded Pipe
ASTM	B 337	Grade 9	53	R56320	Seamless & Welded Pipe
ASTM	B 337	Grade 11	51	R52250	Seamless & Welded Pipe
ASTM	B 337	Grade 12	52	R53400	Seamless & Welded Pipe
ASTM	B 338	Grade 1	51	R50250	Seamless & Welded Tube
ASTM	B 338	Grade 2	51	R50400	Seamless & Welded Tube
ASTM	B 338	Grade 3	52	R50550	Seamless & Welded Tube
ASTM	B 338	Grade 7	51	R52400	Seamless & Welded Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 338	Grade 9	53	R56320	Seamless & Welded Tube
ASTM	B 338	Grade 11	51	R52250	Seamless & Welded Tube
ASTM	B 338	Grade 12	52	R53400	Seamless & Welded Tube
ASTM	B 338	Grade 13	51	R53413	Seamless & Welded Tube
ASTM	B 338	Grade 14	52	R53414	Seamless & Welded Tube
ASTM	B 338	Grade 15	52	R53415	Seamless & Welded Tube
ASTM	B 338	Grade 16	51	R52402	Seamless & Welded Tube
ASTM	B 338	Grade 17	51	R52252	Seamless & Welded Tube
ASTM	B 338	Grade 18	53	R56322	Seamless & Welded Tube
ASTM	B 338	Grade 27	51	—	Seamless & Welded Tube
ASTM	B 338	Grade 28	53	R56323	Seamless & Welded Tube
ASTM	B 338	Grade 30	51	—	Seamless & Welded Tube
ASTM	B 338	Grade 31	52	—	Seamless & Welded Tube
ASTM	B 338	Grade 33	51	—	Seamless & Welded Tube
ASTM	B 338	Grade 34	52	—	Seamless & Welded Tube
ASTM	B 338	Grade 35	54	—	Seamless & Welded Tube
ASTM	B 345	1060	21	A91060	Seamless Pipe & Tube (Gas & Oil Trans.)
ASTM	B 345	3003	21	A93003	Seamless Pipe & Tube (Gas & Oil Trans.)
ASTM	B 345	5083	25	A95083	Extruded Seamless Pipe & Tube
ASTM	B 345	5086	25	A95086	Extruded Seamless Pipe & Tube
ASTM	B 345	6061 (T4, T45, T6, T65)	23	A96061	Extruded Seamless Pipe & Tube
ASTM	B 345	6063 (T1, T4, T5, T6)	23	A96063	Extruded Seamless Pipe & Tube
ASTM	B 345	6351 (T4, T6)	23	A96351	Extruded Seamless Pipe & Tube
ASTM	B 345	Alclad 3003	21	A83003	Seamless Pipe & Tube (Gas & Oil Trans.)
ASTM	B 348	Grade 1	51	R50250	Bars & Shapes
ASTM	B 348	Grade 2	51	R50400	Bars & Shapes
ASTM	B 348	Grade 3	52	R50550	Bars & Shapes
ASTM	B 348	Grade 4 (Unalloyed Ti)	53	R50700	Bars & Shapes
ASTM	B 348	Grade 5	54	R56400	Bars & Shapes
ASTM	B 348	Grade 6	54	R54520	Bars & Shapes
ASTM	B 348	Grade 7	51	R52400	Bars & Shapes
ASTM	B 348	Grade 9	53	R56320	Bars & Shapes
ASTM	B 348	Grade 11	51	R52250	Bars & Shapes
ASTM	B 348	Grade 12	52	R53400	Bars & Shapes
ASTM	B 348	Grade 13	51	R53413	Bars & Shapes
ASTM	B 348	Grade 14	52	R53414	Bars & Shapes
ASTM	B 348	Grade 15	52	R53415	Bars & Shapes
ASTM	B 348	Grade 16	51	R52402	Bars & Shapes
ASTM	B 348	Grade 17	51	R52252	Bars & Shapes
ASTM	B 348	Grade 18	53	R56322	Bars & Shapes
ASTM	B 348	Grade 19	53	R58640	Bars & Shapes
ASTM	B 348	Grade 20	53	R58645	Bars & Shapes
ASTM	B 348	Grade 21	53	R58210	Bars & Shapes
ASTM	B 348	Grade 23	54	R56402	Bars & Shapes

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 348	Grade 24	54	R56405	Bars & Shapes
ASTM	B 348	Grade 25	54	R56403	Bars & Shapes
ASTM	B 348	Grade 30	51	—	Bars & Shapes
ASTM	B 348	Grade 31	52	—	Bars & Shapes
ASTM	B 348	Grade 32	53	—	Bars & Shapes
ASTM	B 348	Grade 33	52	—	Bars & Shapes
ASTM	B 348	Grade 34	52	—	Bars & Shapes
ASTM	B 348	Grade 35	54	—	Bars & Shapes
ASTM	B 351	R60001	61	R60001	Bars, Rod, Wire
ASTM	B 351	R60802	61	R60802	Bars, Rod, Wire
ASTM	B 351	R60804	61	R60804	Bars, Rod, Wire
ASTM	B 351	R60901	62	R60901	Bars, Rod, Wire
ASTM	B 352	R60001	61	R60001	Plate, Sheet & Strip
ASTM	B 352	R60802	61	R60802	Plate, Sheet & Strip
ASTM	B 352	R60804	61	R60804	Plate, Sheet & Strip
ASTM	B 352	R60901	62	R60901	Plate, Sheet & Strip
ASTM	B 353	R60001	61	R60001	Seamless & Welded Tube
ASTM	B 353	R60802	61	R60802	Seamless & Welded Tube
ASTM	B 353	R60804	61	R60804	Seamless & Welded Tube
ASTM	B 353	R60901	62	R60901	Seamless & Welded Tube
ASTM	B 353	R60904	62	R60904	Seamless & Welded Tube
ASTM	B 359	70-30 Cu-Ni	34	C71500	Seamless Tube
ASTM	B 359	80-20 Cu-Ni	34	C71000	Seamless Tube
ASTM	B 359	85-15 Cu-Ni	34	C72200	Seamless Tube
ASTM	B 359	90-10 Cu-Ni	34	C70600	Seamless Tube
ASTM	B 359	95-5 Cu-Ni	34	C70400	Seamless Tube
ASTM	B 359	98.7 min Cu	31	C19200	Seamless Tube
ASTM	B 359	Admiralty, A	32	C44300	Seamless Tube
ASTM	B 359	Admiralty, B	32	C44400	Seamless Tube
ASTM	B 359	Admiralty, C	32	C44500	Seamless Tube
ASTM	B 359	Aluminum Brass B	32	C68700	Seamless Tube
ASTM	B 359	Aluminum Bronze	35	C60800	Seamless Tube
ASTM	B 359	Deoxidized As-Cu (DPA)	31	C14200	Seamless Tube
ASTM	B 359	Deoxidized High P Cu (DHP)	31	C12200	Seamless Tube
ASTM	B 359	Deoxidized Low P Cu (DLP)	31	C12000	Seamless Tube
ASTM	B 359	Oxygen-Free Cu (OF)	31	C10200	Seamless Tube
ASTM	B 359	Oxygen-Free Cu (OFE)	31	C10100	Seamless Tube
ASTM	B 359	Oxygen-Free Cu (OFXLP)	31	C10300	Seamless Tube
ASTM	B 359	Oxygen-Free Low P Cu (OFLP)	31	C10800	Seamless Tube
ASTM	B 359	Red Brass, 85%	32	C23000	Seamless Tube
ASTM	B 361	Alclad 3003	21	A83003	Fittings
ASTM	B 361	WP1060	21	A91060	Fittings
ASTM	B 361	WP1100	21	A91100	Fittings
ASTM	B 361	WP3003	21	A93003	Fittings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 361	WP5154	22	A95154	Fittings
ASTM	B 363	WPT 1	51	R50250	Seamless & Welded Fittings
ASTM	B 363	WPT 2	51	R50400	Seamless & Welded Fittings
ASTM	B 363	WPT 3	52	R50550	Seamless & Welded Fittings
ASTM	B 363	WPT 7	51	R52400	Seamless & Welded Fittings
ASTM	B 363	WPT 9	53	R56320	Seamless & Welded Fittings
ASTM	B 363	WPT 11	51	R52250	Seamless & Welded Fittings
ASTM	B 363	WPT 12	52	R53400	Seamless & Welded Fittings
ASTM	B 363	WPT 13	51	R53413	Seamless & Welded Fittings
ASTM	B 363	WPT 14	52	R53414	Seamless & Welded Fittings
ASTM	B 363	WPT 15	52	R53415	Seamless & Welded Fittings
ASTM	B 363	WPT 16	51	R52402	Seamless & Welded Fittings
ASTM	B 363	WPT 17	51	R52252	Seamless & Welded Fittings
ASTM	B 363	WPT 18	53	R56322	Seamless & Welded Fittings
ASTM	B 363	WPT 19	53	R58640	Seamless & Welded Fittings
ASTM	B 363	WPT 20	53	R58645	Seamless & Welded Fittings
ASTM	B 363	WPT 21	53	R58210	Seamless & Welded Fittings
ASTM	B 363	WPT 23	54	R56402	Seamless & Welded Fittings
ASTM	B 363	WPT 24	54	R56405	Seamless & Welded Fittings
ASTM	B 363	WPT 25	54	R56403	Seamless & Welded Fittings
ASTM	B 363	WPT 30	51	—	Seamless & Welded Fittings
ASTM	B 366	CR1925	45	N08925	Fittings
ASTM	B 366	CR1925N	45	N08926	Fittings
ASTM	B 366	CR20CB	44	N08020	Fittings
ASTM	B 366	CR3033	45	R20033	Fittings
ASTM	B 366	CR3127	45	N08031	Fittings
ASTM	B 366	CR330	46	N08330	Fittings
ASTM	B 366	CR5923	44	N06059	Fittings
ASTM	B 366	CR603GT	43	N06603	Fittings
ASTM	B 366	CR6XN	45	N08367	Fittings
ASTM	B 366	CR904L	45	N08904	Fittings
ASTM	B 366	CRB10	44	N10624	Fittings
ASTM	B 366	CRH120	45	N08120	Fittings
ASTM	B 366	CRH160	44	N12160	Fittings
ASTM	B 366	CRH230	47	N06230	Fittings
ASTM	B 366	CRH556	45	R30556	Fittings
ASTM	B 366	CRHB	44	N10001	Fittings
ASTM	B 366	CRHB2	44	N10665	Fittings
ASTM	B 366	CRHB3	44	N10675	Fittings
ASTM	B 366	CRHC2000	44	N06200	Fittings
ASTM	B 366	CRHC22	44	N06022	Fittings
ASTM	B 366	CRHC276	44	N10276	Fittings
ASTM	B 366	CRHC4	43	N06455	Fittings
ASTM	B 366	CRHG	45	N06007	Fittings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 366	CRHG3	45	N06985	Fittings
ASTM	B 366	CRHG30	45	N06030	Fittings
ASTM	B 366	CRHN	44	N10003	Fittings
ASTM	B 366	CRHX	43	N06002	Fittings
ASTM	B 366	CRM21	43	N06210	Fittings
ASTM	B 366	CRN	41	N02200	Fittings
ASTM	B 366	CRN1C10	45	N08810	Fittings
ASTM	B 366	CRN1C11	45	N08811	Fittings
ASTM	B 366	CRN1CMC	45	N08825	Fittings
ASTM	B 366	CRNC	42	N04400	Fittings
ASTM	B 366	CRNCI	43	N06600	Fittings
ASTM	B 366	CRNCMC	43	N06625	Fittings
ASTM	B 366	CRNIC	44	N08800	Fittings
ASTM	B 366	CRNL	41	N02201	Fittings
ASTM	B 366	CRV45TM	46	N06045	Fittings
ASTM	B 366	CRV602	43	N06025	Fittings
ASTM	B 366	CRVB4	44	N10629	Fittings
ASTM	B 366	WP1925	45	N08925	Fittings
ASTM	B 366	WP1925N	45	N08926	Fittings
ASTM	B 366	WP20CB	44	N08020	Fittings
ASTM	B 366	WP3127	45	N08031	Fittings
ASTM	B 366	WP330	46	N08330	Fittings
ASTM	B 366	WP5923	44	N06059	Fittings
ASTM	B 366	WP603GT	43	N06603	Fittings
ASTM	B 366	WP6XN	45	N08367	Fittings
ASTM	B 366	WP904L	45	N08904	Fittings
ASTM	B 366	WPB10	44	N10624	Fittings
ASTM	B 366	WPH120	45	N08120	Fittings
ASTM	B 366	WPH160	44	N12160	Fittings
ASTM	B 366	WPH230	47	N06230	Fittings
ASTM	B 366	WPH556	45	R30556	Fittings
ASTM	B 366	WPHB	44	N10001	Fittings
ASTM	B 366	WPHB-2	44	N10665	Fittings
ASTM	B 366	WPHB-3	44	N10675	Fittings
ASTM	B 366	WPHC2000	44	N06200	Fittings
ASTM	B 366	WPHC22	44	N06022	Fittings
ASTM	B 366	WPHC276	44	N10276	Fittings
ASTM	B 366	WPHC4	43	N06455	Fittings
ASTM	B 366	WPHG	45	N06007	Fittings
ASTM	B 366	WPHG3	45	N06985	Fittings
ASTM	B 366	WPHG30	45	N06030	Fittings
ASTM	B 366	WPHN	44	N10003	Fittings
ASTM	B 366	WPHX	43	N06002	Fittings
ASTM	B 366	WPM21	43	N06210	Fittings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 366	WPN	41	N02200	Fittings
ASTM	B 366	WPN1C10	45	N08810	Fittings
ASTM	B 366	WPN1C11	45	N08811	Fittings
ASTM	B 366	WPN1CMC	45	N08825	Fittings
ASTM	B 366	WPNC	42	N04400	Fittings
ASTM	B 366	WPNCI	43	N06600	Fittings
ASTM	B 366	WPNCMC	43	N06625	Fittings
ASTM	B 366	WPNIC	44	N08800	Fittings
ASTM	B 366	WPNL	41	N02201	Fittings
ASTM	B 366	WPV45TM	46	N06045	Fittings
ASTM	B 366	WPV602	43	N06025	Fittings
ASTM	B 366	WPVB24	44	N10629	Fittings
ASTM	B 367	Pd 16	51	R52402	Castings (As-Cast)
ASTM	B 367	Pd 17	51	R52252	Castings (As-Cast)
ASTM	B 367	Pd 7B	51	R52401	Castings (As-Cast)
ASTM	B 367	Pd 8A	52	R52401	Castings (As-Cast)
ASTM	B 367	Grade C-2	51	R50400	Castings (As-Cast)
ASTM	B 367	Grade C-3	52	R50550	Castings (As-Cast)
ASTM	B 367	Grade C-5	54	R56400	Castings (As-Cast)
ASTM	B 367	Grade C-6	54	R54520	Castings (As-Cast)
ASTM	B 381	F-1	51	R50250	Forgings
ASTM	B 381	F-2	51	R50400	Forgings
ASTM	B 381	F-3	52	R50550	Forgings
ASTM	B 381	F-4 (Unalloyed Ti)	53	R50700	Forgings
ASTM	B 381	F-5	54	R56400	Forgings
ASTM	B 381	F-6	54	R54520	Forgings
ASTM	B 381	F-7	51	R52400	Forgings
ASTM	B 381	F-9	53	R56320	Forgings
ASTM	B 381	F-11	51	R52250	Forgings
ASTM	B 381	F-12	52	R53400	Forgings
ASTM	B 381	F-13	51	R53413	Forgings
ASTM	B 381	F-14	52	R53414	Forgings
ASTM	B 381	F-15	52	R53415	Forgings
ASTM	B 381	F-16	51	R52402	Forgings
ASTM	B 381	F-17	51	R52252	Forgings
ASTM	B 381	F-18	53	R56322	Forgings
ASTM	B 381	F-19	53	R58640	Forgings (Solution Treated)
ASTM	B 381	F-20	53	R58645	Forgings (Solution Treated)
ASTM	B 381	F-21	53	R58210	Forgings (Solution Treated)
ASTM	B 381	F-23	54	R56402	Forgings
ASTM	B 381	F-24	54	R56405	Forgings
ASTM	B 381	F-25	54	R56403	Forgings
ASTM	B 381	F-30	51	—	Forgings
ASTM	B 381	F-31	52	—	Forgings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 395	70-30 Cu-Ni	34	C71500	Seamless Tube
ASTM	B 395	80-20 Cu-Ni	34	C71000	Seamless Tube
ASTM	B 395	85-15 Cu-Ni	34	C72200	Seamless Tube
ASTM	B 395	90-10 Cu-Ni	34	C70600	Seamless Tube
ASTM	B 395	95-5 Cu-Ni	34	C70400	Seamless Tube
ASTM	B 395	98.7 min Cu	31	C19200	Seamless Tube
ASTM	B 395	Admiralty, A	32	C44300	Seamless Tube
ASTM	B 395	Admiralty, B	32	C44400	Seamless Tube
ASTM	B 395	Admiralty, C	32	C44500	Seamless Tube
ASTM	B 395	Aluminum Brass B	32	C68700	Seamless Tube
ASTM	B 395	Aluminum Bronze	35	C60800	Seamless Tube
ASTM	B 395	Deoxidized As-Cu (DPA)	31	C14200	Seamless Tube
ASTM	B 395	Deoxidized High P Cu (DHP)	31	C12200	Seamless Tube
ASTM	B 395	Deoxidized Low P Cu (DLP)	31	C12000	Seamless Tube
ASTM	B 395	Oxygen-Free Cu (OF)	31	C10200	Seamless Tube
ASTM	B 395	Oxygen-Free Cu (OFXLP)	31	C10300	Seamless Tube
ASTM	B 395	Oxygen-Free Low P Cu (OFLP)	31	C10800	Seamless Tube
ASTM	B 395	Red Brass, 85%	32	C23000	Seamless Tube
ASTM	B 396	5005	21	A95005	Wire (Electrical)
ASTM	B 403	AM100A (-F)	83	M10100	Investment Castings
ASTM	B 403	AZ91C(-F)	83	M11914	Investment Castings
ASTM	B 403	AZ92A(-F)	83	M11920	Investment Castings
ASTM	B 403	K1A(-F)	83	M18010	Investment Castings
ASTM	B 407	Fe-Ni-Cr (Alloy 800)	45	N08800	Seamless Pipe & Tube
ASTM	B 407	Fe-Ni-Cr (Alloy 801)	45	N08801	Seamless Pipe & Tube
ASTM	B 407	Fe-Ni-Cr (Alloy 800H)	45	N08810	Seamless Pipe & Tube
ASTM	B 407	Fe-Ni-Cr (Alloy 800HT)	45	N08811	Seamless Pipe & Tube
ASTM	B 407	Ni-Fe-Cr (Alloy HR120)	45	N08120	Seamless Pipe & Tube
ASTM	B 408	Fe-Ni-Cr (Alloy 800)	45	N08800	Rod & Bar
ASTM	B 408	Fe-Ni-Cr (Alloy 800H)	45	N08810	Rod & Bar
ASTM	B 408	Fe-Ni-Cr (Alloy 800HT)	45	N08811	Rod & Bar
ASTM	B 408	Ni-Fe-Cr (Alloy HR120)	45	N08120	Rod & Bar
ASTM	B 409	Fe-Ni-Cr (Alloy 800)	45	N08800	Plate, Sheet & Strip
ASTM	B 409	Fe-Ni-Cr (Alloy 800H)	45	N08810	Plate, Sheet & Strip
ASTM	B 409	Fe-Ni-Cr (Alloy 800HT)	45	N08811	Plate, Sheet & Strip
ASTM	B 409	Ni-Fe-Cr (Alloy HR120)	45	N08120	Plate, Sheet & Strip
ASTM	B 423	Ni-Fe-Cr-Mo-Cu (Alloy 20Cb3Mod.)	45	N08221	Seamless Pipe & Tube
ASTM	B 423	Ni-Fe-Cr-Mo-Cu (Alloy 825)	45	N08825	Seamless Pipe & Tube
ASTM	B 424	Ni-Fe-Cr-Mo-Cu (Alloy 20Cb3Mod.)	45	N08221	Plate, Sheet & Strip
ASTM	B 424	Ni-Fe-Cr-Mo-Cu (Alloy 825)	45	N08825	Plate, Sheet & Strip
ASTM	B 425	Ni-Fe-Cr-Mo-Cu (Alloy 20Cb3Mod.)	45	N08221	Rod & Bar
ASTM	B 425	Ni-Fe-Cr-Mo-Cu (Alloy 825)	45	N08825	Rod & Bar
ASTM	B 429	6061 (T6)	23	A96061	Extruded Seamless Pipe & Tube
ASTM	B 429	6063 (T6)	23	A96063	Extruded Seamless Pipe & Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 434	Ni-Mo-Cr (Alloy N)	44	N10003	Plate, Sheet & Strip
ASTM	B 435	Fe-Cr-Ni-Co-Mo-W (Alloy 556)	45	R30556	Plate, Sheet & Strip
ASTM	B 435	Ni-Co-Cr-Si (Alloy HR160)	46	N12160	Plate, Sheet & Strip
ASTM	B 435	Ni-Cr-Fe-Mo (Alloy X)	43	N06002	Plate, Sheet & Strip
ASTM	B 435	Ni-Cr-W-Mo (Alloy 230)	43	N06230	Plate, Sheet & Strip
ASTM	B 443	Alloy 625, Grade 1	43	N06625	Cold Rolled Strip & Sheet
ASTM	B 443	Alloy 625, Grade 2	43	N06625	Plate & Hot Rolled Sheet (Sol. Anneal)
ASTM	B 444	Ni-Cr-Mo-Cb (Alloy 625) Grade 1	43	N06625	Pipe & Tube
ASTM	B 444	Ni-Cr-Mo-Cb (Alloy 625) Grade 2	43	N06625	Pipe & Tube
ASTM	B 446	Ni-Cr-Mo-Cb (Alloy 625) Grade 1	43	N06625	Rod & Bar
ASTM	B 446	Ni-Cr-Mo-Cb (Alloy 625) Grade 2	43	N06625	Rod & Bar
ASTM	B 462	Cr-Ni-Fe (Alloy 33)	45	R20033	Forged or Rolled Pipe Flanges, etc.
ASTM	B 462	Fe-Ni-Cr-Mo (Alloy 6XN)	45	N08367	Forged or Rolled Pipe Flanges, etc.
ASTM	B 462	Ni-Fe-Cr-Cu-Mo (Alloy 20Cb3)	45	N08020	Forged or Rolled Pipe Flanges, etc.
ASTM	B 462	Ni-Fe-Cr-Mo-Cu (Alloy 20Mo-4)	45	N08024	Forged or Rolled Pipe Flanges, etc.
ASTM	B 462	Ni-Fe-Cr-Mo-Cu (Alloy 20 Mo-6)	45	N08026	Forged or Rolled Pipe Flanges, etc.
ASTM	B 463	Ni-Fe-Cr-Cu-Mo (Alloy 20Cb3)	45	N08020	Plate, Sheet & Strip
ASTM	B 463	Ni-Fe-Cr-Mo-Cu (Alloy 20Mo-4)	45	N08024	Plate, Sheet & Strip
ASTM	B 463	Ni-Fe-Cr-Mo-Cu (Alloy 20 Mo-6)	45	N08026	Plate, Sheet & Strip
ASTM	B 464	Ni-Fe-Cr-Cu-Mo (Alloy 20Cb3)	45	N08020	Welded Pipe
ASTM	B 464	Ni-Fe-Cr-Mo-Cu (Alloy 20Mo-4)	45	N08024	Welded Pipe
ASTM	B 464	Ni-Fe-Cr-Mo-Cu (Alloy 20 Mo-6)	45	N08026	Welded Pipe
ASTM	B 466	70-30 Cu-Ni	34	C71500	Seamless Pipe & Tube
ASTM	B 466	80-20 Cu-Ni	34	C71000	Seamless Pipe & Tube
ASTM	B 466	85-15 Cu-Ni	34	C72200	Seamless Pipe & Tube
ASTM	B 466	90-10 Cu-Ni	34	C70600	Seamless Pipe & Tube
ASTM	B 466	95-5 Cu-Ni	34	C70400	Seamless Pipe & Tube
ASTM	B 467	70-30 Cu-Ni	34	C71500	Welded Pipe
ASTM	B 467	90-10 Cu-Ni	34	C70600	Welded Pipe
ASTM	B 468	Ni-Fe-Cr-Cu-Mo (Alloy 20Cb3)	45	N08020	Welded Tube
ASTM	B 468	Ni-Fe-Cr-Mo-Cu (Alloy 20Mo-4)	45	N08024	Welded Tube
ASTM	B 468	Ni-Fe-Cr-Mo-Cu (Alloy 20 Mo-6)	45	N08026	Welded Tube
ASTM	B 473	Ni-Fe-Cr-Cu-Mo (Alloy 20Cb3)	45	N08020	Bars
ASTM	B 473	Ni-Fe-Cr-Mo-Cu (Alloy 20Mo-4)	45	N08024	Bars
ASTM	B 473	Ni-Fe-Cr-Mo-Cu (Alloy 20 Mo-6)	45	N08026	Bars
ASTM	B 483	1060	21	A91060	Drawn Tube (Gen. Purpose)
ASTM	B 483	1100	21	A91100	Drawn Tube (Gen. Purpose)
ASTM	B 483	1435	21	A91435	Drawn Tube (Gen. Purpose)
ASTM	B 483	3003	21	A93003	Drawn Tube (Gen. Purpose)
ASTM	B 483	3102	21	A93102	Drawn Tube (Gen. Purpose)
ASTM	B 483	5005	21	A95005	Drawn Tube (Gen. Purpose)
ASTM	B 483	5050	21	A95050	Drawn Tube (Gen. Purpose)
ASTM	B 483	5052	22	A95052	Drawn Tube (Gen. Purpose)
ASTM	B 483	6061 (T4, T6)	23	A96061	Drawn Tube (Gen. Purpose)

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 483	6063 (T4, T6)	23	A96063	Drawn Tube (Gen. Purpose)
ASTM	B 491	1050	21	A91050	Extruded Tube (Gen. Purpose)
ASTM	B 491	1100	21	A91100	Extruded Tube (Gen. Purpose)
ASTM	B 491	1200	21	A91200	Extruded Tube (Gen. Purpose)
ASTM	B 491	1235	21	A91235	Extruded Tube (Gen. Purpose)
ASTM	B 491	3003	21	A93003	Extruded Tube (Gen. Purpose)
ASTM	B 491	3102	21	A93102	Extruded Tube (Gen. Purpose)
ASTM	B 491	6063 (T1)	23	A96063	Extruded Tube (Gen. Purpose)
ASTM	B 493	R60702	61	R60702	Forgings
ASTM	B 493	R60704	61	R60704	Forgings
ASTM	B 493	R60705	62	R60705	Forgings
ASTM	B 505	Grade A Al-Bronze	35	C95200	Continuous Casting Repair
ASTM	B 511	Ni-Fe-Cr-Si (Alloy 330)	45	N08330	Bars & Shapes
ASTM	B 511	Ni-Fe-Cr-Si (Alloy 330 TX)	45	N08332	Bars & Shapes
ASTM	B 512	Alloy 330	45	N08330	Billets & Bars
ASTM	B 514	Ni-Fe-Cr (Alloy HR120)	45	N08120	Welded Pipe
ASTM	B 514	Fe-Ni-Cr (Alloy 800)	45	N08800	Welded Pipe
ASTM	B 514	Fe-Ni-Cr (Alloy 800H)	45	N08810	Welded Pipe
ASTM	B 515	Fe-Ni-Cr (Alloy 800)	45	N08800	Welded Tube
ASTM	B 515	Fe-Ni-Cr (Alloy 800H)	45	N08810	Welded Tube
ASTM	B 515	Fe-Ni-Cr (Alloy 800HT)	45	N08811	Welded Tube
ASTM	B 515	Ni-Fe-Cr (Alloy HR120)	45	N08120	Welded Tube
ASTM	B 516	Ni-Cr-Fe (Alloy 6025 HT)	43	N06025	Welded Tube
ASTM	B 516	Ni-Cr-Fe (Alloy 600)	43	N06600	Welded Tube
ASTM	B 516	Ni-Cr-Fe-Si (Alloy 45)	46	N06045	Welded Tube
ASTM	B 516	Alloy 603 GT	43	N06603	Welded Tube
ASTM	B 517	Ni-Cr-Fe (Alloy 6025 HT)	43	N06025	Welded Pipe
ASTM	B 517	Ni-Cr-Fe (Alloy 600)	43	N06600	Welded Pipe
ASTM	B 517	Ni-Cr-Fe-Si (Alloy 45)	46	N06045	Welded Pipe
ASTM	B 517	Alloy 603GT	43	N06603	Welded Pipe
ASTM	B 523	R60702	61	R60702	Seamless & Welded Tube
ASTM	B 523	R60704	61	R60704	Seamless & Welded Tube
ASTM	B 523	R60705	62	R60705	Seamless & Welded Tube
ASTM	B 535	Ni-Fe-Cr-Si (Alloy 330)	45	N08330	Seamless Pipe & Tube
ASTM	B 535	Ni-Fe-Cr-Si (Alloy 330TX)	45	N08332	Seamless Pipe & Tube
ASTM	B 536	Ni-Fe-Cr-Si (Alloy 330)	45	N08330	Plate, Sheet & Strip
ASTM	B 536	Ni-Fe-Cr-Si (Alloy 330TX)	45	N08332	Plate, Sheet & Strip
ASTM	B 543	70-30 Cu-Ni	34	C71500	Welded Tube
ASTM	B 543	80-20 Cu-Ni	34	C71000	Welded Tube
ASTM	B 543	85-15 Cu-Ni	34	C72200	Welded Tube
ASTM	B 543	90-10 Cu-Ni	34	C70600	Welded Tube
ASTM	B 543	95-5 Cu-Ni	34	C70400	Welded Tube
ASTM	B 543	97.0 min Cu	31	C19400	Welded Tube
ASTM	B 543	Admiralty, A	32	C44300	Welded Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 543	Admiralty, B	32	C44400	Welded Tube
ASTM	B 543	Admiralty, C	32	C44500	Welded Tube
ASTM	B 543	Aluminum Brass B	32	C68700	Welded Tube
ASTM	B 543	Cu-Ni-Fe-Mn	34	C71640	Welded Tube
ASTM	B 543	Deoxidized High P Cu (DHP)	31	C12200	Welded Tube
ASTM	B 543	Oxygen-Free Low P Cu (OFLP)	31	C10800	Welded Tube
ASTM	B 543	Red Brass, 85%	32	C23000	Welded Tube
ASTM	B 547	1100	21	A91100	Roll Formed & Long. Welded Tube
ASTM	B 547	3003	21	A93003	Roll Formed & Long. Welded Tube
ASTM	B 547	3004	22	A93004	Formed Sheet & Arc Welded Tube
ASTM	B 547	5050	21	A95050	Roll Formed & Long. Welded Tube
ASTM	B 547	5052	22	A95052	Formed Sheet & Arc Welded Tube
ASTM	B 547	5083	25	A95083	Formed & Arc Seam Welded Tube
ASTM	B 547	5086	25	A95086	Formed & Arc Seam Welded Tube
ASTM	B 547	5154	22	A95154	Formed Sheet & Arc Welded Tube
ASTM	B 547	5454	22	A95454	Formed Sheet & Arc Welded Tube
ASTM	B 547	6061 (T4, T6)	23	A96061	Formed & Arc Seam Welded Tube
ASTM	B 547	Alclad 3003	21	A83003	Roll Formed & Long. Welded Tube
ASTM	B 547	Alclad 3004	22	A83004	Formed Sheet & Arc Welded Tube
ASTM	B 550	R60702	61	R60702	Bars, Shapes & Wire
ASTM	B 550	R60704	61	R60704	Bars, Shapes & Wire
ASTM	B 550	R60705	62	R60705	Bars, Shapes & Wire
ASTM	B 551	R60702	61	R60702	Sheet, Strip, Plate
ASTM	B 551	R60704	61	R60704	Sheet, Strip, Plate
ASTM	B 551	R60705	62	R60705	Sheet, Strip, Plate
ASTM	B 551	R60706	62	R60706	Sheet, Strip, Plate
ASTM	B 564	99.0 min Ni (Alloy 200)	41	N02200	Forgings
ASTM	B 564	Ni-30 Cu (Alloy 400)	42	N04400	Forgings
ASTM	B 564	Ni-Cr-Mo-(Lo C)-4Fe-3W (Alloy C-22)	43	N06022	Forgings
ASTM	B 564	Ni-Cr-Fe-Al (Alloy 6025 HT)	43	N06025	Forgings
ASTM	B 564	Ni-Cr-Fe-Si (Alloy 45)	46	N06045	Forgings
ASTM	B 564	Ni-Cr-Mo-(Lo C) (Alloy 59)	43	N06059	Forgings
ASTM	B 564	Ni-Cr-Mo-W	43	N06110	Forgings
ASTM	B 564	Alloy C2000	43	N06200	Forgings
ASTM	B 564	Alloy 21	43	N06210	Forgings
ASTM	B 564	Ni-Cr-W-Mo (Alloy 230)	43	N06230	Forgings
ASTM	B 564	Ni-Cr-Fe (Alloy 600)	43	N06600	Forgings
ASTM	B 564	Alloy 603GT	43	N06603	Forgings
ASTM	B 564	Ni-Cr-Co-Mo (Alloy 617)	43	N06617	Forgings
ASTM	B 564	Ni-Cr-Mo-Cb (Alloy 625)	43	N06625	Forgings
ASTM	B 564	Ni-Cr-Mo-W-(Lo C) (Alloy 686)	44	N06686	Forgings
ASTM	B 564	Ni-Cr-Fe (Alloy 690)	43	N06690	Forgings
ASTM	B 564	Fe-Ni-Cr-Mo-Cu (Alloy 31)	45	N08031	Forgings
ASTM	B 564	Ni-Fe-Cr (Alloy HR120)	45	N08120	Forgings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 564	Fe-Ni-Cr-Mo (Alloy AL-6XN)	45	N08367	Forgings
ASTM	B 564	Fe-Ni-Cr (Alloy 800)	45	N08800	Forgings
ASTM	B 564	Fe-Ni-Cr (Alloy 800H)	45	N08810	Forgings
ASTM	B 564	Fe-Ni-Cr (Alloy 800HT)	45	N08811	Forgings
ASTM	B 564	Ni-Fe-Cr-Mo-C (Alloy 825)	45	N08825	Forgings
ASTM	B 564	Ni-Mo-Cr-Fe-W (Alloy C-276)	43	N10276	Forgings
ASTM	B 564	Alloy B-10	43	N10624	Forgings
ASTM	B 564	Alloy CRB10	43	N10624	Forgings
ASTM	B 564	Ni-Mo-Fe (Alloy B-4)	44	N10629	Forgings
ASTM	B 564	Ni-Mo-Cr-Fe (Alloy B-3)	44	N10675	Forgings
ASTM	B 564	Ni-Co-Cr-Si (Alloy HR160)	46	N12160	Forgings
ASTM	B 564	Cr-Ni-Fe (Alloy 33)	45	R20033	Forgings
ASTM	B 572	Ni-Cr-Fe-Mo (Alloy X)	43	N06002	Rod
ASTM	B 572	Ni-Cr-W-Mo (Alloy 230)	43	N06230	Rod
ASTM	B 572	Ni-Co-Cr-Si (Alloy HR160)	46	N12160	Rod
ASTM	B 572	Fe-Cr-Ni-Co-Mo-W (Alloy 556)	45	R30556	Rod
ASTM	B 573	Ni-Mo-Cr-Fe (Alloy N)	44	N10003	Rod
ASTM	B 574	Ni-Cr-Mo-(Lo C)-4Fe-3W (Alloy C22)	43	N06022	Rod
ASTM	B 574	Ni-Cr-Mo-(Lo C) (Alloy 59)	43	N06059	Rod
ASTM	B 574	Alloy C2000	43	N06200	Rod
ASTM	B 574	Ni-Cr-Mo-(Lo C) (Alloy C-4)	43	N06455	Rod
ASTM	B 574	Ni-Cr-Mo-W-(Lo C) (Alloy C686)	43	N06686	Rod
ASTM	B 574	Ni-Mo-Cr-Fe-W-(Lo C) (Alloy C-276)	43	N10276	Rod
ASTM	B 575	Ni-Cr-Mo-(Lo C)-4Fe-3W (Alloy C22)	43	N06022	Plate, Sheet & Strip
ASTM	B 575	Ni-Cr-Mo-(Lo C) (Alloy 59)	43	N06059	Plate, Sheet & Strip
ASTM	B 575	Alloy C2000	43	N06200	Plate, Sheet & Strip
ASTM	B 575	Ni-Cr-Mo-(Lo C) (Alloy C-4)	43	N06455	Plate, Sheet & Strip
ASTM	B 575	Ni-Cr-Mo-W-(Lo C) (Alloy 686)	43	N06686	Plate, Sheet & Strip
ASTM	B 575	Ni-Mo-Cr-Fe-W-(Lo C) (Alloy C-276)	43	N10276	Plate, Sheet & Strip
ASTM	B 581	Ni-Cr-Fe-Mo-Cu (Alloy G)	43	N06007	Rod
ASTM	B 581	Ni-Cr-Fe-Mo-W-Cu (Alloy G-30)	43	N06030	Rod
ASTM	B 581	Ni-Cr-Fe-Mo-Ti (Alloy G-2)	43	N06975	Rod
ASTM	B 581	Ni-Cr-Fe-Mo-Cu (Alloy G-3)	43	N06985	Rod
ASTM	B 582	Ni-Cr-Fe-Mo-Cu (Alloy G)	43	N06007	Plate, Sheet & Strip
ASTM	B 582	Ni-Cr-Fe-Mo-W-Cu (Alloy G-30)	43	N06030	Plate, Sheet & Strip
ASTM	B 582	Ni-Cr-Fe-Mo-Ti (Alloy G-2)	43	N06975	Plate, Sheet & Strip
ASTM	B 582	Ni-Cr-Fe-Mo-Cu (Alloy G-3)	43	N06985	Plate, Sheet & Strip
ASTM	B 599	Alloy 700	45	N08700	Plate, Sheet & Strip
ASTM	B 608	70-30 Cu-Ni	34	C71520	Welded Pipe
ASTM	B 608	90-10 Cu-Ni	34	C70620	Welded Pipe
ASTM	B 608	Aluminum Bronze	35	C61300	Welded Pipe
ASTM	B 608	Aluminum Bronze D	35	C61400	Welded Pipe
ASTM	B 609	1350	21	A91350	Wire (Electrical)
ASTM	B 618	208.0 (F)	26	A02080	Investment Castings

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 618	319.0 (F, T6)	26	A03190	Investment Castings
ASTM	B 618	328.0 (F, T6)	26	A03280	Investment Castings
ASTM	B 618	356.0 (T6, T7, T51, T71)	26	A03560	Investment Castings
ASTM	B 618	443.0 (F)	26	A04430	Investment Castings
ASTM	B 618	514.0 (F)	26	A05140	Investment Castings
ASTM	B 618	535.0 (F)	26	A05350	Investment Castings
ASTM	B 618	A356.0 (T6)	26	A13560	Investment Castings
ASTM	B 618	B443.0 (F)	26	A24430	Investment Castings
ASTM	B 619	Ni-Cr-Fe-Mo (Alloy X)	43	N06002	Welded Pipe
ASTM	B 619	Ni-Cr-Fe-Mo-Cu (Alloy G)	43	N06007	Welded Pipe
ASTM	B 619	Ni-Cr-Mo-(Lo C)-4Fe-3W (Alloy C-22)	43	N06022	Welded Pipe
ASTM	B 619	Ni-Cr-Fe-Mo-Cu (Alloy G-30)	43	N06030	Welded Pipe
ASTM	B 619	Ni-Cr-Mo (Alloy 59)	43	N06059	Welded Pipe
ASTM	B 619	Alloy C2000	43	N06200	Welded Tube
ASTM	B 619	Ni-Cr-W-Mo (Alloy 230)	43	N06230	Welded Pipe
ASTM	B 619	Ni-Cr-Mo (Alloy C-4)	43	N06455	Welded Pipe
ASTM	B 619	Ni-Cr-Mo-W (Alloy 686)	43	N06686	Welded Pipe
ASTM	B 619	Ni-Cr-Fe-Mo (Alloy G-2)	43	N06975	Welded Pipe
ASTM	B 619	Ni-Cr-Fe-Mo-Cu (Alloy G-3)	43	N06985	Welded Pipe
ASTM	B 619	Fe-Ni-Cr-Mo-Cu (Alloy 31)	45	N08031	Welded Pipe
ASTM	B 619	Fe-Ni-Cr-Mo (Alloy 20 Mod.)	45	N08320	Welded Pipe
ASTM	B 619	Ni-Mo-Fe (Alloy B)	44	N10001	Welded Pipe
ASTM	B 619	Ni-Mo-Cr-Fe-W (Alloy C-276)	43	N10276	Welded Pipe
ASTM	B 619	Alloy B-10	44	N10624	Welded Pipe
ASTM	B 619	Ni-Mo-Fe-Cr (Alloy B-4)	44	N10629	Welded Pipe
ASTM	B 619	Ni-Mo (Alloy B-2)	44	N10665	Welded Pipe
ASTM	B 619	Ni-Mo-Cr-Fe (Alloy B-3)	44	N10675	Welded Pipe
ASTM	B 619	Ni-Co-Cr-Si (Alloy HR160)	46	N12160	Welded Pipe
ASTM	B 619	Cr-Ni-Fe (Alloy 33)	45	R20033	Welded Pipe
ASTM	B 619	Fe-Cr-Ni-Co-Mo-W (Alloy 556)	45	R30556	Welded Pipe
ASTM	B 620	Fe-Ni-Cr-Mo (Alloy 20 Mod.)	45	N08320	Plate, Sheet & Strip
ASTM	B 621	Fe-Ni-Cr-Mo (Alloy 20 Mod.)	45	N08320	Rod
ASTM	B 622	Ni-Cr-Fe-Mo (Alloy X)	43	N06002	Seamless Pipe & Tube
ASTM	B 622	Ni-Cr-Fe-Mo-Cu (Alloy G)	43	N06007	Seamless Pipe & Tube
ASTM	B 622	Ni-Cr-Mo-(Lo C)-4Fe-3W (Alloy C-22)	43	N06022	Seamless Pipe & Tube
ASTM	B 622	Ni-Cr-Fe-Mo-W-Cu (Alloy G-30)	43	N06030	Seamless Pipe & Tube
ASTM	B 622	Ni-Cr-Mo-Fe (Alloy 59)	43	N06059	Seamless Pipe & Tube
ASTM	B 622	Ni-Cr-Mo-Fe (Alloy 2060 Mo)	43	N06060	Seamless Pipe & Tube
ASTM	B 622	Alloy C2000	43	N06200	Seamless Pipe & Tube
ASTM	B 622	Ni-Cr-W-Mo (Alloy 230)	43	N06230	Seamless Pipe & Tube
ASTM	B 622	Ni-Cr-Mo (Alloy 2050)	43	N06250	Seamless Pipe & Tube
ASTM	B 622	Ni-Cr-Fe-Mo-W (Alloy 2550)	43	N06255	Seamless Pipe & Tube
ASTM	B 622	Ni-Cr-Mo-W (Alloy 686)	43	N06686	Seamless Pipe & Tube
ASTM	B 622	Ni-Cr-Fe-Mo-Ti (Alloy G-2)	43	N06975	Seamless Pipe & Tube

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 622	Ni-Cr-Fe-Mo-Cu (Alloy G-3)	43	N06985	Seamless Pipe & Tube
ASTM	B 622	Fe-Ni-Cr-Mo-Cu (Alloy 31)	45	N08031	Seamless Pipe & Tube
ASTM	B 622	Fe-Ni-Cr-Mo-W (Alloy 2035)	45	N08135	Seamless Pipe & Tube
ASTM	B 622	Fe-Ni-Cr-Mo (Alloy 20 Mod.)	45	N08320	Seamless Pipe & Tube
ASTM	B 622	Fe-Ni-Cr-Mo-Cu	45	N08535	Seamless Pipe & Tube
ASTM	B 622	Ni-Mo-Fe (Alloy B)	44	N10001	Seamless Pipe & Tube
ASTM	B 622	Ni-Mo-Cr-Fe-W (Alloy C-276)	43	N10276	Seamless Pipe & Tube
ASTM	B 622	Alloy B-10	44	N10624	Seamless Pipe & Tube
ASTM	B 622	Ni-Mo-Fe-Cr (Alloy B-4)	44	N10629	Seamless Pipe & Tube
ASTM	B 622	Ni-Mo (Alloy B-2)	44	N10665	Seamless Pipe & Tube
ASTM	B 622	Ni-Mo-Cr-Fe (Alloy B-3)	44	N10675	Seamless Pipe & Tube
ASTM	B 622	Ni-Co-Cr-Si (Alloy HR160)	46	N12160	Seamless Pipe & Tube
ASTM	B 622	Cr-Ni-Fe-Mo (Alloy 33)	45	R20033	Seamless Pipe & Tube
ASTM	B 622	Fe-Cr-Ni-Co-Mo-W (Alloy 556)	45	R30556	Seamless Pipe & Tube
ASTM	B 625	Fe-Ni-Cr-Mo-Cu (Alloy 31)	45	N08031	Plate, Sheet & Strip
ASTM	B 625	Fe-Ni-Cr-Mo (Alloy 904L)	45	N08904	Plate, Sheet & Strip
ASTM	B 625	Fe-Ni-Cr-Mo-Cu-(Lo C) (Alloy 1925)	45	N08925	Plate, Sheet & Strip
ASTM	B 625	Fe-Ni-Cr-Mo-Cu-(Lo C) (Alloy 926)	45	N08926	Plate, Sheet & Strip
ASTM	B 625	Fe-Ni-Cr-Mo-Cu-(Lo C) (Alloy UR-SB-8)	45	N08932	Plate, Sheet & Strip
ASTM	B 625	Cr-Ni-Fe-Mo (Alloy 33)	45	R20033	Plate, Sheet & Strip
ASTM	B 626	Ni-Cr-Fe-Mo	43	N06002	Welded Tube
ASTM	B 626	Ni-Cr-Fe-Mo (Alloy G)	43	N06007	Welded Tube
ASTM	B 626	Ni-Cr-Mo-(Lo C)-4Fe-3W (Alloy C-22)	43	N06022	Welded Tube
ASTM	B 626	Ni-Cr-Fe-Mo (Alloy G30)	43	N06030	Welded Tube
ASTM	B 626	Ni-Cr-Mo (Alloy 59)	43	N06059	Welded Tube
ASTM	B 626	Ni-Cr-Mo-(Low C)-Cu (Alloy C2000)	43	N06200	Welded Tube
ASTM	B 626	Ni-Cr-W-Mo (Alloy 230)	43	N06230	Welded Tube
ASTM	B 626	Ni-Cr-Mo (Alloy C-4)	43	N06455	Welded Tube
ASTM	B 626	Ni-Cr-Mo-W (Alloy 686)	43	N06686	Welded Tube
ASTM	B 626	Ni-Cr-Fe-Mo-Ti (Alloy G-2)	43	N06975	Welded Tube
ASTM	B 626	Ni-Cr-Fe-Mo-Cu (Alloy G-3)	43	N06985	Welded Tube
ASTM	B 626	Fe-Ni-Cr-Mo-Cu (Alloy 31)	45	N08031	Welded Tube
ASTM	B 626	Fe-Ni-Cr-Mo (Alloy 20 Mod.)	45	N08320	Welded Tube
ASTM	B 626	Ni-Mo-Fe (Alloy B)	44	N10001	Welded Tube
ASTM	B 626	Ni-Mo-Cr-Fe-W (Alloy C-276)	43	N10276	Welded Tube
ASTM	B 626	Alloy B-10	44	N10624	Welded Tube
ASTM	B 626	Ni-Mo-Fe (Alloy B-4)	44	N10629	Welded Tube
ASTM	B 626	Ni-Mo (Alloy B-2)	44	N10665	Welded Tube
ASTM	B 626	Ni-Mo-Cr-Fe (Alloy B-3)	44	N10675	Welded Tube
ASTM	B 626	Ni-Co-Cr-Si (Alloy HR160)	46	N12160	Welded Tube
ASTM	B 626	Fe-Cr-Ni-Mo (Alloy 33)	45	R20033	Welded Tube
ASTM	B 626	Fe-Cr-Ni-Co-Mo-W (Alloy 556)	45	R30556	Welded Tube
ASTM	B 632	6061 (T4, T6)	23	A96061	Tread Plate
ASTM	B 649	Ni-Fe-Cr-Mo-Cu (Alloy 31)	45	N08031	Bar & Wire

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 649	Fe-Ni-Cr-Mo (Alloy 904L)	45	N08904	Bar & Wire
ASTM	B 649	Fe-Ni-Cr-Mo-Cu-(Lo C) (Alloy 1925)	45	N08925	Bar & Wire
ASTM	B 649	Fe-Ni-Cr-Mo-Cu-(Lo C) (Alloy 926)	45	N08926	Bar & Wire
ASTM	B 649	Cr-Fe-Ni-Mo (Alloy 33)	45	R20033	Bar & Wire
ASTM	B 658	R60702	61	R60702	Seamless & Welded Pipe
ASTM	B 658	R60704	61	R60704	Seamless & Welded Pipe
ASTM	B 658	R60705	62	R60705	Seamless & Welded Pipe
ASTM	B 668	Ni-Fe-Cr-Mo-Cu (Alloy 28)	45	N08028	Seamless Tube
ASTM	B 672	Fe-Ni-Cr-Mo-Cb (Alloy 700)	45	N08700	Bar
ASTM	B 673	Fe-Ni-Cr-Mo (Alloy 904L)	45	N08904	Welded Pipe
ASTM	B 673	Fe-Ni-Cr-Mo-Cu-N (Alloy 1925)	45	N08925	Welded Pipe
ASTM	B 673	Fe-Ni-Cr-Cu (Alloy 926)	45	N08926	Welded Pipe
ASTM	B 674	Fe-Ni-Cr-Mo (Alloy 904L)	45	N08904	Welded Tube
ASTM	B 674	Fe-Ni-Cr-Mo-Cu-N (Alloy 1925)	45	N08925	Welded Tube
ASTM	B 674	Fe-Ni-Cr-Cu (Alloy 926)	45	N08926	Welded Tube
ASTM	B 675	Fe-Ni-Cr-Mo	45	N08366	Welded Pipe
ASTM	B 675	Fe-Ni-Cr-Mo (Alloy AL-6XN)	45	N08367	Welded Pipe
ASTM	B 676	Fe-Ni-Cr-Mo	45	N08366	Welded Tube
ASTM	B 676	Fe-Ni-Cr-Mo (Alloy AL-6XN)	45	N08367	Welded Tube
ASTM	B 677	Fe-Ni-Cr-Mo (Alloy 904L)	45	N08904	Seamless Pipe & Tube
ASTM	B 677	Fe-Ni-Cr-Mo-Cu-(Lo C) (Alloy 1925)	45	N08925	Seamless Pipe & Tube
ASTM	B 677	Fe-Ni-Cr-Mo-Cu-(Lo C) (Alloy 926)	45	N08926	Seamless Pipe & Tube
ASTM	B 686	A356.0 (T61)	26	A13560	Investment Castings
ASTM	B 688	Fe-Ni-Cr-Mo	45	N08366	Plate, Sheet & Strip
ASTM	B 688	Fe-Ni-Cr-Mo (Alloy AL-6XN)	45	N08367	Plate, Sheet & Strip
ASTM	B 690	Fe-Ni-Cr-Mo	45	N08366	Seamless Pipe & Tube
ASTM	B 690	Fe-Ni-Cr-Mo (Alloy AL-6XN)	45	N08367	Seamless Pipe & Tube
ASTM	B 691	Fe-Ni-Cr-Mo	45	N08366	Round & Square Rods & Bars
ASTM	B 691	Fe-Ni-Cr-Mo (Alloy AL-6XN)	45	N08367	Round & Square Rods & Bars
ASTM	B 704	Ni-Cr-Mo-Cb (Alloy 625)	43	N06625	Welded Tube
ASTM	B 704	Ni-Fe-Cr-Mo-Cu-Ti (Alloy 825)	45	N08825	Welded Tube
ASTM	B 705	Ni-Cr-Mo-Cb (Alloy 625)	43	N06625	Welded Pipe
ASTM	B 705	Ni-Fe-Cr-Mo-Cu-Ti (Alloy 825)	45	N08825	Welded Pipe
ASTM	B 709	Ni-Fe-Cr-Mo-Cu (Alloy 28)	45	N08028	Plate, Sheet & Strip
ASTM	B 710	Ni-Fe-Cr-Si (Alloy 330)	45	N08330	Welded Pipe
ASTM	B 710	Ni-Fe-Cr-Si (Alloy 330TX)	45	N08332	Welded Pipe
ASTM	B 718	Ni-Cr-Mo-Co-W-Si (Alloy 333)	45	N06333	Plate, Sheet & Strip
ASTM	B 719	Ni-Cr-Mo-Co-W-Si (Alloy 333)	45	N06333	Bars
ASTM	B 720	Fe-Cr-Ni-Mo	45	N08310	Seamless Tube
ASTM	B 722	Ni-Cr-Mo-Co-W-Si (Alloy 333)	45	N06333	Seamless Pipe & Tube
ASTM	B 723	Ni-Cr-Mo-Co-W-Si (Alloy 333)	45	N06333	Welded Pipe
ASTM	B 726	Ni-Cr-Mo-Co-W-Si (Alloy 333)	45	N06333	Welded Tube
ASTM	B 755	Ni-Cr-Mo-W	43	N06110	Plate, Sheet & Strip
ASTM	B 756	Ni-Cr-Mo-W	43	N06110	Rod & Bar

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 757	Ni-Cr-Mo-W	43	N06110	Welded Pipe
ASTM	B 758	Ni-Cr-Mo-W	43	N06110	Welded Tube
ASTM	B 759	Ni-Cr-Mo-W	43	N06110	Pipe & Tube
ASTM	B 804	Alloy AL-6XN	45	N08367	Welded Pipe & Tube
ASTM	B 819	Deoxidized High P Cu (DHP)	31	C12200	Seamless Tube
ASTM	B 861	Grade 1	51	R50250	Seamless Pipe
ASTM	B 861	Grade 2	51	R50400	Seamless Pipe
ASTM	B 861	Grade 3	52	R50550	Seamless Pipe
ASTM	B 861	Grade 5	54	R56400	Seamless Pipe
ASTM	B 861	Grade 7	51	R52400	Seamless Pipe
ASTM	B 861	Grade 9	53	R56320	Seamless Pipe
ASTM	B 861	Grade 11	51	R52250	Seamless Pipe
ASTM	B 861	Grade 12	52	R53400	Seamless Pipe
ASTM	B 861	Grade 13	51	R53413	Seamless Pipe
ASTM	B 861	Grade 14	52	R53414	Seamless Pipe
ASTM	B 861	Grade 15	52	R53415	Seamless Pipe
ASTM	B 861	Grade 16	51	R52402	Seamless Pipe
ASTM	B 861	Grade 17	51	R52252	Seamless Pipe
ASTM	B 861	Grade 18	53	R56322	Seamless Pipe
ASTM	B 861	Grade 19	53	R58640	Seamless Pipe
ASTM	B 861	Grade 20	53	R58645	Seamless Pipe
ASTM	B 861	Grade 21	53	R58210	Seamless Pipe
ASTM	B 861	Grade 23	54	R56402	Seamless Pipe
ASTM	B 861	Grade 24	54	R56405	Seamless Pipe
ASTM	B 861	Grade 25	54	R56403	Seamless Pipe
ASTM	B 861	Grade 28	53	R56323	Seamless Pipe
ASTM	B 861	Grade 29	54	R56404	Seamless Pipe
ASTM	B 861	Grade 33	51	—	Seamless Pipe
ASTM	B 861	Grade 34	52	—	Seamless Pipe
ASTM	B 861	Grade 35	54	—	Seamless Pipe
ASTM	B 862	Grade 1	51	R50250	Welded Pipe
ASTM	B 862	Grade 2	51	R50400	Welded Pipe
ASTM	B 862	Grade 3	52	R50550	Welded Pipe
ASTM	B 862	Grade 5	54	R56400	Welded Pipe
ASTM	B 862	Grade 7	51	R52400	Welded Pipe
ASTM	B 862	Grade 9	53	R56320	Welded Pipe
ASTM	B 862	Grade 11	51	R50250	Welded Pipe
ASTM	B 862	Grade 12	52	R53400	Welded Pipe
ASTM	B 862	Grade 13	51	R53413	Welded Pipe
ASTM	B 862	Grade 14	52	R53414	Welded Pipe
ASTM	B 862	Grade 15	52	R53415	Welded Pipe
ASTM	B 862	Grade 16	51	R52402	Welded Pipe
ASTM	B 862	Grade 17	51	R52252	Welded Pipe
ASTM	B 862	Grade 18	53	R56322	Welded Pipe

(Continued)

Table D.1 (Continued)
List of Base Metal Specifications—Nonferrous Alloys

Standard	Base Metal Specification	Type, Grade, or Alloy Designation	Material Number	UNS Number	Product Form
ASTM	B 862	Grade 19	53	R58640	Welded Pipe
ASTM	B 862	Grade 20	53	R58645	Welded Pipe
ASTM	B 862	Grade 21	53	R58210	Welded Pipe
ASTM	B 862	Grade 23	54	R56402	Welded Pipe
ASTM	B 862	Grade 24	54	R56405	Welded Pipe
ASTM	B 862	Grade 25	54	R56403	Welded Pipe
ASTM	B 862	Grade 26	51	R52404	Welded Pipe
ASTM	B 862	Grade 27	51	R52254	Welded Pipe
ASTM	B 862	Grade 28	53	R56323	Welded Pipe
ASTM	B 862	Grade 29	54	R56404	Welded Pipe
ASTM	B 862	Grade 33	51	—	Welded Pipe
ASTM	B 862	Grade 34	52	—	Welded Pipe
ASTM	B 862	Grade 35	54	—	Welded Pipe
AMS	4914	15-3	53	R58153	Sheet (Solution Treated)
AMS	4915	8Al-1 Mo-1 V	54	R54810	Sheet, Strip & Plate (Single Annealed)
AMS	4919	Al-Zr-Mo-Sn	54	R54620	Sheet (Duplex Annealed)
AMS	4973	Al-Mo-V	54	R54810	Forgings (Solution Treated & Stabilized)
AMS	4975	Al-Zr-Mo-Sn	54	R54620	Bar (Solution Treated, Duplex Annealed)
AMS	4976	Al-Zr-Mo-Sn	54	R54620	Forging, STA (Duplex Annealed)
AMS	5711	Ni-Cr-Mo	44	N06635	Sheet
ISO	209	7020 (T5)	27	A97020	Ext. Bar, Rod, Wire, Shapes & Tube
ISO	209	6082 (T4, T6)	23	A96082	Ext. Rod, Bar, Shapes & Tube
NACE	MR-01-75	Ni-Cr-Fe-Mo	45	N06950	Pipe

Table D.2
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	ASTM A 27	Grade 60-30	J03000	—	60/30 [415/205]	Castings	C
1	1	ASTM A 27	Grade U-60-30	J03000	—	60/30 [415/205]	Castings	C
1	1	ASTM A 27	Grade 65-35	J03001	—	65/35 [450/240]	Castings	C
1	1	ASTM A 31	Grade B	K03100	—	58/29 [400/200]	Rivets	C
1	1	ASTM A 36	A36	K02599	≤0.75 [19]	58/36 [400/248]	Plate & Bars	C-Mn-Si
1	1	ASTM A 36	A36	K02598	>0.75 ≤1.5 [>19 ≤38]	58/36 [400/248]	Plate & Bars	C-Mn-Si
1	1	ASTM A 36	A36	K02597	>1.5 ≤2.5 [>38 ≤64]	58/36 [400/248]	Plate & Bars	C-Mn-Si
1	1	ASTM A 36	A36	K02596	>2.5 ≤4.0 [>64 ≤100]	58/36 [400/248]	Plate & Bars	C-Mn-Si
1	1	ASTM A 36	A36	K02595	>4.0 ≤8.0 [>100 ≤200]	58/36 [400/248]	Plate & Bars	C-Mn-Si
1	1	ASTM A 36	A36	K02595	>8.00 [200]	58/32 [400/221]	Plate	C-Mn-Si
1	1	ASTM A 36	A36	K02600	≤4.0 [100]	58/36 [400/248]	Shapes	C-Mn-Si
1	1	ASTM A 53	Type E, Grade A	K02504	—	48/30 [331/207]	Resistance Welded Pipe	C
1	1	ASTM A 53	Type E, Grade B	K03005	—	60/35 [414/241]	Resistance Welded Pipe	C-Mn
1	1	ASTM A 53	Type F, Grade A	—	—	48/30 [331/207]	Furnace Welded Pipe	C
1	1	ASTM A 53	Type S, Grade A	K02504	—	48/30 [331/207]	Seamless Pipe	C
1	1	ASTM A 53	Type S, Grade B	K03005	—	60/35 [414/241]	Seamless Pipe	C-Mn
1	1	ASTM A 106	Grade A	K02501	—	48/30 [331/207]	Seamless Pipe	C-Mn
1	1	ASTM A 106	Grade B	K03006	—	60/35 [414/241]	Seamless Pipe	C-Mn
1	1	ASTM A 108	Grade 1015 CW	G10150	—	43/25 [296/172]	Bar	C
1	1	ASTM A 108	Grade 1018 CW	G10180	—	43/25 [296/172]	Bar	C
1	1	ASTM A 108	Grade 1020 CW	G10200	—	43/25 [296/172]	Bar	C
1	1	ASTM A 131	Grade A	K02300	≤1.0 [25]	58/34 [400/234]	Structural	C
1	1	ASTM A 131	Grade A	K02300	>1.0 [25]	58/32 [400/221]	Structural	C
1	1	ASTM A 131	Grade B	K02102	—	58/34 [400/234]	Structural	C
1	1	ASTM A 131	Grade D	K02101	—	58/34 [400/234]	Structural	C-Si
1	1	ASTM A 131	Grade E	K01801	—	58/34 [400/234]	Structural	C-Si
1	1	ASTM A 131	Grade CS	K01601	—	58/34 [400/234]	Structural	C-Si
1	1	ASTM A 131	Grade DS	K01601	—	58/34 [400/234]	Structural	C-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	ASTM A 134	A36	—	—	58/36 [400/248]	Welded Pipe	C
1	1	ASTM A 134	A283 A	—	—	45/24 [310/165]	Welded Pipe	C
1	1	ASTM A 134	A283 B	—	—	50/27 [345/186]	Welded Pipe	C
1	1	ASTM A 134	A283 C	K02401	—	55/30 [379/207]	Welded Pipe	C
1	1	ASTM A 134	A283 D	K02702	—	60/33 [414/228]	Welded Pipe	C
1	1	ASTM A 134	A285 A	K01700	—	45/24 [310/165]	Welded Pipe	C
1	1	ASTM A 134	A285 B	K02200	—	50/27 [345/186]	Welded Pipe	C
1	1	ASTM A 134	A285 C	K02801	—	55/30 [379/207]	Welded Pipe	C
1	1	ASTM A 135	Grade A	—	—	48/30 [331/207]	ERW Pipe	C
1	1	ASTM A 135	Grade B	—	—	60/35 [414/241]	ERW Pipe	C-Mn
1	1	ASTM A 139	Grade A	—	—	48/30 [331/207]	Welded Pipe	C-Mn
1	1	ASTM A 139	Grade B	K03003	—	60/35 [414/241]	Welded Pipe	C-Mn
1	1	ASTM A 139	Grade C	K03004	—	60/42 [414/290]	Welded Pipe	C-Mn
1	1	ASTM A 139	Grade D	K03010	—	60/46 [414/317]	Welded Pipe	C-Mn
1	1	ASTM A 161	Low Carbon	K01504	—	47/26 [324/179]	Low C Tube	C
1	1	ASTM A 178	Grade A	K01200	—	47/26 [324/179]	ERW Tube	C
1	1	ASTM A 178	Grade C	K03503	—	60/37 [414/255]	ERW Tube	C
1	1	ASTM A 179	—	K01200	—	47/26 [324/179]	Seamless Tube	C
1	1	ASTM A 181	Class 60	K03502	—	60/30 [414/207]	Pipe Flanges	C-Si
1	1	ASTM A 192	—	K01201	—	47/26 [324/179]	Seamless Tube	C-Si
1	1	ASTM A 210	Grade A1	K02707	—	60/37 [414/255]	Seamless Tube	C-Si
1	1	ASTM A 214	—	K01807	—	47/26 [324/179]	ERW Tube	C
1	1	ASTM A 216	Grade WCA	J02502	—	60/30 [414/207]	Castings	C-Si
1	1	ASTM A 226	—	K01201	—	47/26 [324/179]	ERW Tube	C-Si
1	1	ASTM A 234	Grade WPB	K03006	—	60/35 [414/241]	Pipe Fittings	C-Si
1	1	ASTM A 252	Grade 1	—	—	50/30 [345/207]	Pipe Piles	C
1	1	ASTM A 252	Grade 2	—	—	60/35 [414/241]	Pipe Piles	C
1	1	ASTM A 252	Grade 3	—	—	66/45 [455/310]	Pipe Piles	C
1	1	ASTM A 266	Grade 1	K03506	—	60/30 [414/207]	Seamless Forging	C-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	ASTM A 283	Grade A	K01804	—	45/24 [310/165]	Plate	C
1	1	ASTM A 283	Grade B	K02001	—	50/27 [345/186]	Plate	C
1	1	ASTM A 283	Grade C	K02401	—	55/30 [379/207]	Plate	C
1	1	ASTM A 283	Grade D	K02702	—	60/33 [414/228]	Plate	C
1	1	ASTM A 285	Grade A	K01700	—	45/24 [310/165]	Plate	C
1	1	ASTM A 285	Grade B	K02200	—	50/27 [345/186]	Plate	C
1	1	ASTM A 285	Grade C	K02801	—	55/30 [379/207]	Plate	C
1	1	ASTM A 333	Grade 1	K03008	—	55/30 [379/207]	Seamless & Welded Pipe	C-Mn
1	1	ASTM A 333	Grade 6	K03006	—	60/35 [414/241]	Seamless & Welded Pipe	C-Mn-Si
1	1	ASTM A 334	Grade 1	K03008	—	55/30 [379/207]	Welded Tube	C-Mn
1	1	ASTM A 334	Grade 6	K03006	—	60/35 [414/241]	Welded Tube	C-Mn-Si
1	1	ASTM A 350	Grade LFI	K03009	—	60/30 [414/207]	Forging	C-Mn-Si
1	1	ASTM A 352	Grade LCA	J02504	—	60/30 [414/207]	Castings	C-Si
1	1	ASTM A 352	Grade LCB	J03003	—	65/35 [448/241]	Castings	C-Si
1	1	ASTM A 366	Commercial Quality	—	—	43/20 [296/138]	Sheet	C
1	1	ASTM A 369	Grade FPA	K02501	—	48/30 [331/207]	Forging	C-Si
1	1	ASTM A 369	Grade FPB	K03006	—	60/35 [414/241]	Forging	C-Mn
1	1	ASTM A 372	Grade A or Type 1	K03002	—	60/35 [414/241]	Forging	C-Si
1	1	ASTM A 381	Class Y35	K03013	—	60/35 [414/241]	Pipe	C-Mn
1	1	ASTM A 381	Class Y42	—	—	60/42 [414/290]	Pipe	C-Mn
1	1	ASTM A 381	Class Y46	—	—	63/46 [434/317]	Pipe	C-Mn
1	1	ASTM A 381	Class Y48	—	—	62/48 [427/331]	Pipe	C-Mn
1	1	ASTM A 414	Grade A	K01501	—	45/25 [310/172]	Sheet	C
1	1	ASTM A 414	Grade B	K02201	—	50/30 [345/207]	Sheet	C
1	1	ASTM A 414	Grade C	K02503	—	55/33 [379/228]	Sheet	C
1	1	ASTM A 414	Grade D	K02505	—	60/35 [414/241]	Sheet	C-Mn
1	1	ASTM A 414	Grade E	K02704	—	65/38 [448/262]	Sheet	C-Mn
1	1	ASTM A 420	Grade WPL6	—	—	60/35 [414/241]	Pipe Fittings	C-Mn-Si
1	1	ASTM A 500	Grade A round	K03000	—	45/33 [310/228]	Tube	C

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
1	1	ASTM	A 500	Grade B round	K03000	—	58/42 [400/290]	Tube	C
1	1	ASTM	A 500	Grade C round	K02705	—	62/46 [427/317]	Tube	C
1	1	ASTM	A 500	Grade D	—	—	58/36 [400/250]	Welded Tube	C
1	1	ASTM	A 501	—	K03000	—	58/36 [400/248]	Tube	C
1	1	ASTM	A 501	Grade A	—	—	58/36 [400/250]	Welded Tube	C
1	1	ASTM	A 512	Grade 1010	G10100	—	40/20 [276/138]	Mechanical Tube	C
1	1	ASTM	A 512	Grade 1015	G10150	—	40/20 [276/138]	Mechanical Tube	C
1	1	ASTM	A 512	Grade 1117	G11170	—	40/20 [276/138]	Mechanical Tube	C
1	1	ASTM	A 512	Grade 1018	G10180	—	43/25 [296/172]	Mechanical Tube	C
1	1	ASTM	A 512	Grade 1020	G10200	—	50/30 [345/207]	Mechanical Tube	C
1	1	ASTM	A 512	Grade 1025	G10250	—	55/35 [379/241]	Mechanical Tube	C
1	1	ASTM	A 512	Grade MT1010	G10100	—	40/20 [276/138]	Mechanical Tube	C
1	1	ASTM	A 512	Grade MT1015	G10150	—	43/25 [296/172]	Mechanical Tube	C
1	1	ASTM	A 512	Grade MT1020	G10200	—	50/30 [345/207]	Mechanical Tube	C
1	1	ASTM	A 512	Grade MTX1015	—	—	40/20 [276/138]	Mechanical Tube	C
1	1	ASTM	A 512	Grade MTX1020	—	—	50/30 [345/207]	Mechanical Tube	C
1	1	ASTM	A 513	Grade 1015 CW	G10150	—	65/55 [448/379]	Mechanical Tube	C
1	1	ASTM	A 513	Grade 1008	G10080	—	42/30 [290/207]	Mechanical Tube	C
1	1	ASTM	A 513	Grade 1010	G10100	—	45/32 [310/221]	Mechanical Tube	C
1	1	ASTM	A 513	Grade 1015	G10150	—	48/35 [331/241]	Mechanical Tube	C
1	1	ASTM	A 513	Grade 1017	G10170	—	48/35 [331/241]	Mechanical Tube	C
1	1	ASTM	A 513	Grade 1018	G10180	—	48/35 [331/241]	Mechanical Tube	C
1	1	ASTM	A 513	Grade 1019	G10190	—	48/35 [331/241]	Mechanical Tube	C
1	1	ASTM	A 513	Grade 1020	G10200	—	52/38 [359/262]	Mechanical Tube	C
1	1	ASTM	A 513	Grade 1021	G10210	—	54/40 [372/276]	Mechanical Tube	C
1	1	ASTM	A 513	Grade 1025	G10250	—	56/40 [386/276]	Mechanical Tube	C
1	1	ASTM	A 515	Grade 55	K02001	—	55/30 [379/207]	Plate	C-Si
1	1	ASTM	A 515	Grade 60	K02401	—	60/32 [414/221]	Plate	C-Si
1	1	ASTM	A 515	Grade 65	K02800	—	65/35 [448/241]	Plate	C-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	ASTM	A 516	Grade 55	K01800	—	Plate	C-Mn-Si
1	1	ASTM	A 516	Grade 60	K02100	—	Plate	C-Mn-Si
1	1	ASTM	A 516	Grade 65	K02403	—	Plate	C-Mn-Si
1	1	ASTM	A 519	Grade 1008	G10080	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1012	G10120	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1016	G10160	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1017	G10170	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1018	G10180	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1018 HR	G10180	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1019	G10190	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1020	G10200	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1020 HR	G10200	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1021	G10210	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1022	G10220	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1022 HR	G10220	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1025	G10250	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1025 HR	G10250	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1026	G10260	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade 1026 HR	G10260	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade MT1010	G10100	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade MT1015	G10150	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade MT1020	G10200	—	Mechanical Tube	C
1	1	ASTM	A 519	Grade MTX1015	—	—	Mechanical Tube	C
1	1	ASTM	A 521	Class CC	—	—	Die Forging	C
1	1	ASTM	A 521	Class CCI	—	—	Die Forging	C
1	1	ASTM	A 523	Grade A	K02504	—	Pipe	C-Mn
1	1	ASTM	A 523	Grade B	K03005	—	Pipe	C-Mn
1	1	ASTM	A 524	Grade I	K02104	—	Pipe	C-Mn-Si
1	1	ASTM	A 524	Grade II	K02104	—	Pipe	C-Mn-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	ASTM	A 526	Grade II	K02104	—	Galvanized Sheet	—
1	1	ASTM	A 527	Grade II	K02104	—	Galvanized Sheet	—
1	1	ASTM	A 529	Grade 42	K02703	60/42 [414/290]	Structural	1.35maxMn-0.27maxC
1	1	ASTM	A 539	—	K01506	45/35 [310/241]	Coiled Tube	C
1	1	ASTM	A 556	Grade A2	K01807	47/26 [324/179]	Seamless Tube	C
1	1	ASTM	A 556	Grade B2	K02707	60/37 [414/255]	Seamless Tube	C-Si
1	1	ASTM	A 557	Grade A2	K01807	47/26 [324/179]	Tube-RW	C
1	1	ASTM	A 557	Grade B2	K03007	60/37 [414/255]	Tube-RW	C
1	1	ASTM	A 562	—	K11224	55/30 [379/207]	Plate	C-Mn-Ti
1	1	ASTM	A 569	Grade 30	K02502	49/30 [338/207]	Sheet & Strip	C
1	1	ASTM	A 569	Grade 33	K02502	52/33 [359/228]	Sheet & Strip	C
1	1	ASTM	A 569	Grade 36	K02502	53/36 [365/248]	Sheet & Strip	C
1	1	ASTM	A 569	Grade 40	K02502	53/40 [365/276]	Sheet & Strip	C
1	1	ASTM	A 569	Grade 45	K02502	60/45 [414/310]	Sheet & Strip	C
1	1	ASTM	A 569	Grade 50	K02502	65/50 [448/345]	Sheet & Strip	C
1	1	ASTM	A 570	Grade 30	K02502	49/30 [338/207]	Sheet & Strip	C
1	1	ASTM	A 570	Grade 33	K02502	52/33 [359/228]	Sheet & Strip	C
1	1	ASTM	A 570	Grade 36	K02502	53/36 [365/248]	Sheet & Strip	C
1	1	ASTM	A 570	Grade 40	K02502	55/40 [379/276]	Sheet & Strip	C
1	1	ASTM	A 570	Grade 45	K02502	60/45 [414/310]	Sheet & Strip	C
1	1	ASTM	A 570	Grade 50	K02502	65/50 [448/345]	Sheet & Strip	C
1	1	ASTM	A 570	Grade 55	K02502	70/55 [483/379]	Sheet & Strip	C
1	1	ASTM	A 572	Grade 42	K02303	60/42 [414/290]	Plate & Bars	C-Mn-Si
1	1	ASTM	A 572	Grade 42	K02303	60/42 [414/290]	Shapes	C-Mn-Si
1	1	ASTM	A 572	Grade 50	K02304	65/50 [448/345]	Plate & Bars	C-Mn-Si
1	1	ASTM	A 572	Grade 50	K02304	65/50 [448/345]	Shapes	C-Mn-Si
1	1	ASTM	A 573	Grade 58	K02301	58/32 [400/221]	Plate	C-Mn-Si
1	1	ASTM	A 573	Grade 65	K02404	65/35 [448/241]	Plate	C-Mn-Si
1	1	ASTM	A 575	Grade M1008	G10080	40/20 [276/138]	Bar	C

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
1	1	ASTM	A 575	Grade M1010	G10100	—	40/20 [276/138]	Bar	C
1	1	ASTM	A 575	Grade M1012	G10120	—	40/20 [276/138]	Bar	C
1	1	ASTM	A 575	Grade M1015	G10150	—	40/20 [276/138]	Bar	C
1	1	ASTM	A 575	Grade M1017	G10170	—	40/20 [276/138]	Bar	C
1	1	ASTM	A 575	Grade M1020	G10200	—	50/30 [345/207]	Bar	C
1	1	ASTM	A 575	Grade M1023	G10230	—	55/35 [379/241]	Bar	C
1	1	ASTM	A 575	Grade M1025	G10250	—	55/35 [379/241]	Bar	C
1	1	ASTM	A 576	Grade 1008	G10080	—	40/20 [276/138]	Bar	C
1	1	ASTM	A 576	Grade 1010	G10100	—	40/20 [276/138]	Bar	C
1	1	ASTM	A 576	Grade 1012	G10120	—	40/20 [276/138]	Bar	C
1	1	ASTM	A 576	Grade 1015	G10150	—	40/20 [276/138]	Bar	C
1	1	ASTM	A 576	Grade 1016	G10160	—	40/20 [276/138]	Bar	C
1	1	ASTM	A 576	Grade 1017	G10170	—	40/20 [276/138]	Bar	C
1	1	ASTM	A 576	Grade 1018	G10180	—	45/25 [310/172]	Bar	C
1	1	ASTM	A 576	Grade 1019	G10190	—	45/25 [310/172]	Bar	C
1	1	ASTM	A 576	Grade 1020	G10200	—	50/30 [345/207]	Bar	C
1	1	ASTM	A 576	Grade 1021	G10210	—	50/30 [345/207]	Bar	C
1	1	ASTM	A 576	Grade 1022	G10220	—	50/30 [345/207]	Bar	C
1	1	ASTM	A 576	Grade 1023	G10230	—	55/35 [379/241]	Bar	C
1	1	ASTM	A 576	Grade 1025	G10250	—	55/35 [379/241]	Bar	C
1	1	ASTM	A 587	—	K11500	—	48/30 [331/207]	Pipe	C
1	1	ASTM	A 587	Grade A2	K01807	—	47/26 [324/179]	Tube-RW	C
1	1	ASTM	A 587	Grade B2	K03007	—	60/37 [414/255]	Tube-RW	C
1	1	ASTM	A 607	Grade 45	—	—	65/45 [448/310]	Sheet & Strip	C-Mn-Cb-V
1	1	ASTM	A 607	Grade 50	—	—	65/50 [448/345]	Sheet & Strip	C-Mn-Cb-V
1	1	ASTM	A 611	Grade A	G10170	—	42/25 [290/172]	Sheet & Strip	C-Mn
1	1	ASTM	A 611	Grade B	G10170	—	45/30 [310/207]	Sheet & Strip	C-Mn
1	1	ASTM	A 611	Grade C	G10170	—	48/33 [331/228]	Sheet & Strip	C-Mn
1	1	ASTM	A 611	Grade D	G10120	—	52/40 [359/276]	Sheet & Strip	C-Mn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
1	1	ASTM	A 618	Grade III	K12700	—	65/50 [448/345]	Tube	Mn-V
1	1	ASTM	A 620	Types A	K00040	—	40/22 [276/152]	Sheet	C
1	1	ASTM	A 620	Types B	K00040	—	40/22 [276/152]	Sheet	C
1	1	ASTM	A 633	Grade A	K01802	—	63/42 [434/290]	Plate & Shapes	Mn-Cb
1	1	ASTM	A 653	Grade 33	—	—	45/33 [310/228]	Galvanized Sheet	—
1	1	ASTM	A 653	Grade 37	—	—	52/37 [359/255]	Galvanized Sheet	—
1	1	ASTM	A 653	Grade 40	—	—	55/40 [379/276]	Galvanized Sheet	—
1	1	ASTM	A 653	Grade 80	—	—	82/80 [565/552]	Galvanized Sheet	—
1	1	ASTM	A 656	Grade 50	K11804	≤2 [50]	60/50 [414/345]	Hi-Str. Lo-Alloy Plate	1.65maxMn-0.6Si-0.18maxC
1	1	ASTM	A 656	Grade 60	K11804	≤1.5 [38]	70/60 [483/414]	Hi-Str. Lo-Alloy Plate	1.65maxMn-0.6Si-0.18maxC
1	1	ASTM	A 659	1015	—	—	—	Sheet & Strip	C
1	1	ASTM	A 659	1016	—	—	—	Sheet & Strip	C
1	1	ASTM	A 659	1017	—	—	—	Sheet & Strip	C
1	1	ASTM	A 659	1018	—	—	—	Sheet & Strip	C
1	1	ASTM	A 659	1020	—	—	—	Sheet & Strip	C
1	1	ASTM	A 659	1021	—	—	—	Sheet & Strip	C
1	1	ASTM	A 659	1023	—	—	—	Sheet & Strip	C
1	1	ASTM	A 660	Grade WCA	J02504	—	60/30 [414/207]	Centrifugal Cast Pipe	C
1	1	ASTM	A 662	Grade A	K01701	—	58/40 [400/276]	Plate	C-Mn-Si
1	1	ASTM	A 662	Grade B	K02203	—	65/40 [448/276]	Plate	C-Mn-Si
1	1	ASTM	A 663	Grade 45	—	—	45/25 [310/172]	Bar	C
1	1	ASTM	A 663	Grade 45	—	—	45/25 [310/172]	Shapes, Rounds, Squares, Hex.	C
1	1	ASTM	A 663	Grade 50	—	—	50/28 [345/193]	Bar	C
1	1	ASTM	A 663	Grade 50	—	—	50/28 [345/193]	Shapes, Rounds, Squares, Hex.	C
1	1	ASTM	A 663	Grade 55	—	—	55/30 [379/207]	Bar	C
1	1	ASTM	A 663	Grade 55	—	—	55/30 [379/207]	Shapes, Rounds, Squares, Hex.	C
1	1	ASTM	A 663	Grade 60	—	—	60/33 [414/228]	Bar	C
1	1	ASTM	A 663	Grade 60	—	—	60/33 [414/228]	Shapes, Rounds, Squares, Hex.	C
1	1	ASTM	A 663	Grade 65	—	—	65/36 [448/248]	Bar	C

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	ASTM A 663	Grade 65	—	—	65/36 [448/248]	Shapes, Rounds, Squares, Hex.	C
1	1	ASTM A 668	Class B	G10200	—	60/30 [414/207]	Forging	C
1	1	ASTM A 668	Class C	G10250	—	66/30 [455/207]	Forging	C
1	1	ASTM A 671	Grade CA55	K02801	—	55/30 [379/207]	Fusion Welded Pipe	C
1	1	ASTM A 671	Grade CB60	K02401	—	60/32 [414/221]	Fusion Welded Pipe	C-Mn-Si
1	1	ASTM A 671	Grade CB65	K02800	—	65/35 [448/241]	Fusion Welded Pipe	C-Mn-Si
1	1	ASTM A 671	Grade CC60	K02100	—	60/32 [414/221]	Fusion Welded Pipe	C-Mn-Si
1	1	ASTM A 671	Grade CC65	K02403	—	65/35 [448/241]	Fusion Welded Pipe	C-Mn-Si
1	1	ASTM A 671	Grade CE55	—	—	55/30 [397/207]	Fusion Welded Pipe	C
1	1	ASTM A 671	Grade CE60	—	—	60/32 [415/205]	Fusion Welded Pipe	C
1	1	ASTM A 672	Grade A45	K01700	—	45/24 [310/165]	Fusion Welded Pipe	C
1	1	ASTM A 672	Grade A50	K02200	—	50/27 [345/186]	Fusion Welded Pipe	C
1	1	ASTM A 672	Grade A55	K02801	—	55/30 [379/207]	Fusion Welded Pipe	C
1	1	ASTM A 672	Grade B55	—	—	55/30 [397/207]	Fusion Welded Pipe	C
1	1	ASTM A 672	Grade B60	K02401	—	60/32 [414/221]	Fusion Welded Pipe	C-Si
1	1	ASTM A 672	Grade B65	K02800	—	65/35 [448/241]	Fusion Welded Pipe	C-Si
1	1	ASTM A 672	Grade C55	K01800	—	55/30 [379/207]	Fusion Welded Pipe	C-Mn-Si
1	1	ASTM A 672	Grade C60	K02100	—	60/32 [414/221]	Fusion Welded Pipe	C-Mn-Si
1	1	ASTM A 672	Grade C65	K02403	—	65/35 [448/241]	Fusion Welded Pipe	C-Mn-Si
1	1	ASTM A 672	Grade E55	—	—	55/30 [397/207]	Fusion Welded Pipe	C
1	1	ASTM A 672	Grade E60	K02402	—	60/32 [414/221]	Fusion Welded Pipe	C-Mn-Si
1	1	ASTM A 675	Grade 45	—	—	45/22.5 [310/155]	Bar	C
1	1	ASTM A 675	Grade 50	—	—	50/25 [345/172]	Bar	C
1	1	ASTM A 675	Grade 55	—	—	55/27.5 [379/190]	Bar	C
1	1	ASTM A 675	Grade 60	—	—	60/30 [414/207]	Bar	C
1	1	ASTM A 675	Grade 65	—	—	65/32.5 [448/224]	Bar	C
1	1	ASTM A 695	Type B	K03504	—	60/35 [414/241]	Bar	C-Mn-Si
1	1	ASTM A 696	Grade B	K03200	—	60/35 [414/241]	Bar	C-Mn-Si
1	1	ASTM A 707	Grade L1, Class 1	K02302	—	60/42 [414/290]	Forging	C-Mn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	ASTM	A 707	Grade L2, Class 1	K03301	—	Forging	C-Mn
1	1	ASTM	A 707	Grade L3, Class 1	K12510	—	Forging	1.3Mn-V
1	1	ASTM	A 707	Grade L4, Class 1	K12089	—	Forging	1.8Ni-0.55Mn-0.25Mo
1	1	ASTM	A 707	Grade L5, Class 1	K20934	—	Forging	1.2Cu-0.9Ni-0.7Cr-0.5Mn
1	1	ASTM	A 709	Grade 36	—	—	Plate, Bars, & Shapes	C-Mn-Si
1	1	ASTM	A 709	Grade 50	—	—	Plate, Bars, & Shapes	C-Mn-Si
1	1	ASTM	A 709	Grade 50S	—	—	Plates, Bars, & Shapes	C-Mn-Si
1	1	ASTM	A 727	—	K02506	—	Forging	C-Mn-Si
1	1	ASTM	A 765	Grade 1	K03046	—	Forging	C-Mn-Si
1	1	ASTM	A 795	1 Type, Grade B	—	60/- [414/-]	Resistance Welded Pipe	C-Mn
1	1	ASTM	A 795	Type E, Grade A	—	60/- [414/-]	Resistance Welded Pipe	C-Mn
1	1	ASTM	A 795	Type S, Grade A	—	60/- [414/-]	Seamless Pipe	C-Mn
1	1	ASTM	A 795	Type S, Grade B	—	60/- [414/-]	Seamless Pipe	C-Mn
1	1	ASTM	A 795	Type F	—	60/- [414/-]	Furnace-Welded Pipe	—
1	1	ASTM	A 808	—	K11852	≤1.5 [38]	Structural	C-Mn-Si-Cb-W
1	1	ASTM	A 808	—	K11852	>1.5 ≤2.0 [>38 ≤50]	Structural	C-Mn-Si-Cb-W
1	1	ASTM	A 808	—	K11852	>2.0 ≤2.5 [>50 ≤64]	Structural	C-Mn-Si-Cb-W
1	1	ASTM/AISI	A 830	1006	G10060	—	Plate	C
1	1	ASTM/AISI	A 830	1008	G10080	—	Plate	C
1	1	ASTM/AISI	A 830	1009	G10090	—	Plate	C
1	1	ASTM/AISI	A 830	1010	G10100	—	Plate	C
1	1	ASTM/AISI	A 830	1012	G10120	—	Plate	C
1	1	ASTM/AISI	A 830	1015	G10150	—	Plate	C
1	1	ASTM/AISI	A 830	1016	G10160	—	Plate	C
1	1	ASTM/AISI	A 830	1017	G10170	—	Plate	C
1	1	ASTM/AISI	A 830	1018	G10180	—	Plate	C
1	1	ASTM/AISI	A 830	1019	G10190	—	Plate	C
1	1	ASTM/AISI	A 830	1020	G10200	—	Plate	C
1	1	ASTM/AISI	A 830	1021	G10210	—	Plate	C

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
1	1	ASTM/AISI	A 830	1022	G10220	—	43/25 [296/172]	Plate	C
1	1	ASTM/AISI	A 830	1023	G10230	—	43/25 [296/172]	Plate	C
1	1	ASTM/AISI	A 830	1025	G10250	—	50/30 [345/207]	Plate	C
1	1	ASTM	A 836	Class 1	—	—	55/25 [379/172]	Forging	C-Si-Ti
1	1	ASTM	A 857	Grade 25	—	—	38/25 [262/172]	Sheet Piling	1.5maxMn-0.35max P-0.25maxC-0.2minCu
1	1	ASTM	A 857	Grade 30	—	—	49/30 [338/207]	Sheet Piling	1.5maxMn-0.35max P-0.25maxC-0.2minCu
1	1	ASTM	A 857	Grade 33	—	—	52/33 [359/228]	Sheet Piling	1.5maxMn-0.35max P-0.25maxC-0.2minCu
1	1	ASTM	A 857	Grade 36	—	—	53/36 [365/248]	Sheet Piling	1.5maxMn-0.35max P-0.25maxC-0.2minCu
1	1	ASTM	A 935	Grade 45, Class 1	—	—	65/45 [448/310]	Sheet & Strip	C-Mn-Cb-V
1	1	ASTM	A 935	Grade 45, Class 2	—	—	55/45 [379/310]	Sheet & Strip	C-Mn-Cb-V
1	1	ASTM	A 935	Grade 50, Class 1	—	—	65/50 [448/345]	Sheet & Strip	C-Mn-Cb-V
1	1	ASTM	A 935	Grade 50, Class 2	—	—	60/50 [414/345]	Sheet & Strip	C-Mn-Cb-V
1	1	ASTM	A 984	Grade 35	—	—	60/35 [414/241]	Line Pipe	C
1	1	ASTM	A 992	—	—	—	65/50 [448/345]	Structural Shapes	C-Mn-Si
1	1	ASTM	A 1008	CS Type B	—	—	45/30 [310/205]	Sheet	C
1	1	ASTM	A 1008	DS Type B	—	—	45/30 [310/205]	Sheet	C
1	1	ASTM	A 1008	HSLAS Grade 45 cl 1	—	—	60/45 [410/310]	Sheet & Strip	C
1	1	ASTM	A 1008	HSLAS Grade 45 cl 2	—	—	55/45 [380/310]	Sheet & Strip	C
1	1	ASTM	A 1008	HSLAS Grade 50 cl 1	—	—	65/50 [450/340]	Sheet & Strip	C
1	1	ASTM	A 1008	HSLAS Grade 50 cl 2	—	—	60/50 [410/340]	Sheet & Strip	C
1	1	ASTM	A 1008	HSLAS Grade 55 cl 2	—	—	65/55 [450/380]	Sheet & Strip	C
1	1	ASTM	A 1008	HSLAS-F Grade 50	—	—	60/50 [410/340]	Sheet & Strip	C
1	1	ASTM	A 1008	SS Grade 25	—	—	42/25 [290/170]	Sheet	—
1	1	ASTM	A 1008	SS Grade 30	—	—	45/30 [310/205]	Sheet	—
1	1	ASTM	A 1008	SS Grade 33 Type 1, 2	—	—	48/33 [330/230]	Sheet	—

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	ASTM	A 1008	SS Grade 40 Type 1, 2	—	52/40 [360/275]	Sheet	—
1	1	ASTM	A 1011	CS Type B	—	45/30 [310/205]	Sheet	C
1	1	ASTM	A 1011	DS Type B	—	45/30 [310/205]	Sheet	C
1	1	ASTM	A 1011	SS Grade 30	—	45/30 [310/205]	Sheet	—
1	1	ASTM	A 1011	SS Grade 33	—	45/30 [310/205]	Sheet	—
1	1	ASTM	A 1011	SS Grade 36, Type 1	—	53/36 [365/250]	Sheet	—
1	1	ASTM	A 1011	SS Grade 36, Type 2	—	58/36 [400/250]	Sheet	—
1	1	ASTM	A 1011	SS Grade 40	—	55/40 [380/275]	Sheet	—
1	1	ASTM	A 1011	SS Grade 45	—	60/45 [410/310]	Sheet	—
1	1	ASTM	A 1011	SS Grade 50	—	65/50 [450/340]	Sheet	—
1	1	ASTM	A 1011	HSLAS Grade 45 Class 1	—	60/45 [410/310]	Sheet	—
1	1	ASTM	A 1011	HSLAS Grade 45 Class 2	—	55/45 [380/310]	Sheet	—
1	1	ASTM	A 1011	HSLAS Grade 50 Class 1	—	65/50 [450/340]	Sheet	—
1	1	ASTM	A 1011	HSLAS Grade 50 Class 2	—	60/50 [410/340]	Sheet	—
1	1	ASTM	A 1011	HSLAS-F Grade 50	—	53/36 [365/250]	Sheet & Strip	C
1	1	ASTM	A 1011	HSLAS Grade 55 Class 2	—	65/55 [450/380]	Sheet	—
1	1	ASTM	A 1018	HSLAS Grade 45 cl 1	—	60/45 [410/310]	Sheet & Strip	C
1	1	ASTM	A 1018	HSLAS Grade 45 cl 2	—	55/45 [380/310]	Sheet & Strip	C
1	1	ASTM	A 1018	HSLAS Grade 50 cl 1	—	65/50 [450/340]	Sheet & Strip	C
1	1	ASTM	A 1018	HSLAS Grade 50 cl 2	—	60/50 [410/340]	Sheet & Strip	C
1	1	ASTM	A 1018	HSLAS Grade 55 cl 2	—	65/55 [450/380]	Sheet & Strip	C
1	1	ASTM	A 1018	HSLAS-F Grade 50	—	60/50 [410/340]	Sheet & Strip	C
1	1	ABS	ABS	Grade A	K02300	58/34 [400/234]	Ordinary Strength Hull Structural Steel	C

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	ABS	Grade B	K02102	—	58/34 [400/234]	Ordinary Strength Hull Structural Steel	C
1	1	ABS	Grade D	K02101	—	58/34 [400/234]	Ordinary Strength Hull Structural Steel	C-Si
1	1	ABS	Grade E	K01801	—	58/34 [400/234]	Ordinary Strength Hull Structural Steel	C-Si
1	1	ABS	Grade AH32	K11846	—	64/46 [441/317]	High Strength Hull Structural Steel	C-Mn-Si
1	1	ABS	Grade DH32	K11846	—	64/46 [441/317]	High Strength Hull Structural Steel	C-Mn-Si
1	1	ABS	Grade EH32	K11846	—	64/46 [441/317]	High Strength Hull Structural Steel	C-Mn-Si
1	1	ABS	Grade FH32	K11846	—	64/46 [441/317]	High Strength Hull Structural Steel	C-Mn-Si
1	1	2H	Grade 42	—	—	62/42 [427/290]	Structural	C-Mn-Si
1	1	API	Grade A25, Class I	—	—	45/25 [310/172]	Pipe & Tube	C-Mn
1	1	API	Grade A25, Class II	—	—	45/25 [310/172]	Pipe & Tube	C-Mn
1	1	API	Grade A	—	—	48/30 [331/207]	Pipe	C-Mn
1	1	API	Grade B	—	—	60/35 [414/241]	Pipe	C-Mn
1	1	API	Grade 42	—	—	60/42 [414/290]	Pipe	C-Mn
1	1	API	Grade X46	—	—	63/46 [434/317]	Pipe	C-Mn
1	1	API	Grade X42	—	—	62/42 [427/290]	Pipe	C-Mn
1	1	API	Grade 50	—	—	65/50 [448/345]	Pipe	C-Mn
1	1	AS	7-430	—	≤0.625 [16]	62/44 [427/303]	Plate	C
1	1	AS	7-430	—	>0.625 ≤1.56 [>16≤40]	62/41 [427/283]	Plate	C
1	1	AS	7-430	—	>1.56 ≤3.125 [>40≤78]	62/39 [427/269]	Plate	C
1	1	AS	7-430	—	>3.125 ≤6 [>78≤150]	62/36 [427/248]	Plate	C
1	1	AS/NZS	200	—	≤0.5 [13]	44/29 [303/200]	Plate	C
1	1	AS/NZS	250	—	≤0.31 [8]	60/41 [414/283]	Plate	C-Mn
1	1	AS/NZS	250	—	>0.31 ≤0.5 [>8≤13]	60/38 [414/262]	Plate	C-Mn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	AS/NZS 3678	250	—	>0.5 ≤2 [$>13 \leq 50$]	60/36 [414/248]	Plate	C-Mn
1	1	AS/NZS 3678	250	—	>2 ≤3.125 [$50 \leq 78$]	60/35 [414/241]	Plate	C-Mn
1	1	AS/NZS 3678	250	—	>3.125 ≤6 [$>78 \leq 150$]	60/33 [414/228]	Plate	C-Mn
1	1	AS/NZS 3678	250L15	—	≤0.31 [8]	60/41 [414/283]	Plate	C-Mn
1	1	AS/NZS 3678	250L15	—	>0.31 ≤0.5 [$>8 \leq 13$]	60/38 [414/262]	Plate	C-Mn
1	1	AS/NZS 3678	250L15	—	>0.5 ≤2 [$>13 \leq 50$]	60/36 [414/248]	Plate	C-Mn
1	1	AS/NZS 3678	250L15	—	>2 ≤3.125 [$>50 \leq 78$]	60/35 [414/241]	Plate	C-Mn
1	1	AS/NZS 3678	250L15	—	>3.125 ≤6 [$>78 \leq 150$]	60/35 [414/241]	Plate	C-Mn
1	1	AS/NZS 3679.1	250/250L0/250L15	—	<0.44 [11]	60/38 [414/262]	Flats & Sections	C-Mn
1	1	AS/NZS 3679.1	250/250L0/250L15	—	≥0.44 <0.625 [$\geq 11 < 16$]	60/36 [414/248]	Flats & Sections	C-Mn
1	1	AS/NZS 3679.1	250/250L0/250L15	—	≥0.625 <1.56 [$\geq 16 < 40$]	60/36 [414/248]	Flats & Sections	C-Mn
1	1	AS/NZS 3679.1	250/250L0/250L15	—	≥1.56 [40]	60/33 [414/228]	Flats & Sections	C-Mn
1	1	AS/NZS 3679.1	250/250L0/250L15	—	≤2 [50]	60/36 [414/248]	Hex, Squares & Rounds	C-Mn
1	1	AS/NZS 3679.1	250/250L0/250L15	—	>2 ≥4 [$>50 \geq 100$]	60/33 [414/228]	Hex, Squares & Rounds	C-Mn
1	1	AS/NZS 1594	HA1	—	—	44/29 [303/200]	Strip	C
1	1	AS/NZS 1594	HA3	—	—	44/29 [303/200]	Strip	C
1	1	AS/NZS 1594	HA4N	—	—	41/25 [283/172]	Strip	C
1	1	AS/NZS 1594	HA200	—	—	44/29 [303/200]	Strip	C
1	1	AS/NZS 1594	HA250	—	—	51/36 [352/248]	Strip	C
1	1	AS/NZS 1594	HU250	—	—	51/36 [352/248]	Strip	C-Mn
1	1	AS/NZS 1594	HA250/1	—	—	50/36 [345/248]	Strip	C
1	1	AS/NZS 1594	HA300	—	—	58/44 [400/303]	Strip	C-Mn
1	1	AS/NZS 1594	HU300	—	—	58/44 [400/303]	Strip	C-Mn
1	1	AS/NZS 1594	HA300/1	—	—	62/44 [427/303]	Strip	C-Mn
1	1	AS/NZS 1594	HU300/1	—	—	62/44 [427/303]	Strip	C-Mn
1	1	AS/NZS 1594	HA350	—	—	62.3/51 [429/352]	Strip	C-Mn
1	1	AS/NZS 1594	HW350	—	—	65/49 [448/338]	Strip	C-Mn-Cr-Ni-Cu
1	1	AS/NZS 1594	HA400	—	—	67/55 [462/379]	Strip	C-Mn
1	1	AS/NZS 1594	XF300	—	—	64/44 [441/303]	Strip	C-Mn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	1	AS/NZS 1594	XF400	—	—	67/55 [462/379]	Strip	C-Mn
1	1	CSA G40.20/40.21	260W	—	—	60/38 [414/262]	Structural	C
1	1	CSA G40.20/40.21	260WT	—	—	60/38 [414/262]	Structural	C
1	1	CSA G40.20/40.21	300W	—	—	65/44 [448/303]	Structural	C-Mn-Cb-V
1	1	CSA G40.20/40.21	300WT	—	—	65/44 [448/303]	Structural	C-Mn-Cb-V
1	1	CSA Z245.1	172	—	—	45/25 [310/172]	Pipe	C
1	1	CSA Z245.1	207	—	—	48/30 [331/207]	Pipe	C
1	1	CSA Z245.1	241	—	—	60/35 [414/241]	Pipe	C
1	1	CSA Z245.1	290	—	—	60/42 [414/290]	Pipe	C
1	1	CSA Z245.11	207	—	—	48/30 [331/207]	Steel Fittings	C-Mn-Si
1	1	CSA Z245.11	241	—	—	60/35 [414/241]	Steel Fittings	C-Mn-Si
1	1	CSA Z245.11	290	—	—	60/42 [414/290]	Steel Fittings	C-Mn-Si
1	1	CSA Z245.12	248	—	—	60/36 [414/248]	Steel Flanges	C-Mn-Si
1	1	CSA Z245.12	290	—	—	60/42 [414/290]	Steel Flanges	C-Mn-Si
1	1	MSS SP75	WPHY-42	—	—	60/42 [414/290]	Seamless & Welded Fittings	C-Mn
1	1	MSS SP75	WPHY-46	—	—	63/46 [434/317]	Seamless & Welded Fittings	C-Mn
1	1	MSS SP75	WPHY-52	—	—	66/52 [455/359]	Seamless & Welded Fittings	C-Mn
1	2	ASTM A 27	Grade 70-36	J03501	—	70/36 [485/250]	Castings	C
1	2	ASTM A 27	Grade 70-40	J02501	—	70/40 [485/275]	Castings	C
1	2	ASTM A 105	—	K03504	—	70/36 [483/248]	Pipe Flanges	C-Mn
1	2	ASTM A 106	Grade C	K03501	—	70/40 [483/276]	Seamless Pipe	C-Mn
1	2	ASTM A 131	Grade AH32	K11846	—	64/46 [441/317]	Structural	C-Mn-Si
1	2	ASTM A 131	Grade AH36	K11852	—	71/51 [490/352]	Structural	C-Mn-Si
1	2	ASTM A 131	Grade DH32	K11846	—	64/46 [441/317]	Structural	C-Mn-Si
1	2	ASTM A 131	Grade DH36	K11852	—	71/51 [490/352]	Structural	C-Mn-Si
1	2	ASTM A 131	Grade EH32	K11846	—	64/46 [441/317]	Structural	C-Mn-Si
1	2	ASTM A 131	Grade EH36	K11852	—	71/51 [490/352]	Structural	C-Mn-Si
1	2	ASTM A 139	Grade E	K03012	—	66/52 [455/359]	Welded Pipe	C-Mn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	2	ASTM A 178	Grade D	—	—	70/40 [483/276]	ERW Tube	C-Mn
1	2	ASTM A 181	Class 70	K03502	—	70/36 [483/248]	Pipe Flanges	C-Si
1	2	ASTM A 210	Grade C	K03501	—	70/40 [483/276]	ERW Tube	C-Mn
1	2	ASTM A 216	Grade WCB	J03002	—	70/36 [483/248]	Castings	C-Si
1	2	ASTM A 216	Grade WCC	J02503	—	70/40 [483/276]	Castings	C-Mn-Si
1	2	ASTM A 234	Grade WPC	K03501	—	70/40 [483/276]	Pipe Fittings	C-Si
1	2	ASTM A 242	Type 1	K11510	≤3/4 [19]	70/50 [483/345]	Shapes, Plates & Bars	LowC-P-Cu
1	2	ASTM A 242	Type 1	K11510	>3/4 ≤1.5 [>19 ≤38]	67/46 [462/317]	Shapes, Plates & Bars	LowC-P-Cu
1	2	ASTM A 242	Type 1	K11510	>1.5 ≤4.0 [>38 ≤100]	63/42 [434/390]	Shapes, Plates & Bars	LowC-P-Cu
1	2	ASTM A 266	Grade 2	K03506	—	70/36 [483/248]	Seamless Forging	C-Si
1	2	ASTM A 266	Grade 3	K05001	—	75/37.5 [517/259]	Seamless Forging	C-Si
1	2	ASTM A 266	Grade 4	K03017	—	70/36 [483/248]	Seamless Forging	C-Mn-Si
1	2	ASTM A 299	Grade A	K02803	≤1.00 [25]	75/42 [517/290]	Plate	C-Mn-Si
1	2	ASTM A 299	Grade A	K02803	>1.00 [25]	75/40 [517/276]	Plate	C-Mn-Si
1	2	ASTM A 350	Grade LF2	K03011	—	70/36 [483/248]	Forging	C-Mn-Si
1	2	ASTM A 350	Grade LF6, Class 1	K12202	—	66/52 [455/359]	Forging	1.3Mn-Si-V-N
1	2	ASTM A 350	Grade LF787, Class 2	—	—	65/55 [448/379]	Forging	1.15Cu-0.85Ni-0.75Cr-0.5Mn
1	2	ASTM A 352	Grade LCC	J02505	—	70/40 [483/276]	Castings	C-Mn-Si
1	2	ASTM A 372	Grade B	K04001	—	75/45 [417/310]	Forging	C-Mn-Si
1	2	ASTM A 381	Class Y50	—	—	64/50 [441/345]	Pipe	C-Mn
1	2	ASTM A 381	Class Y52	—	—	66/52 [455/359]	Pipe	C-Mn
1	2	ASTM A 381	Class Y56	—	—	71/56 [490/386]	Pipe	C-Mn
1	2	ASTM A 414	Grade F	K03102	—	70/42 [483/290]	Sheet	C-Mn
1	2	ASTM A 414	Grade G	K03103	—	75/45 [417/310]	Sheet	C-Mn
1	2	ASTM A 441	—	K12211	≤0.75 [19]	70/50 [485/345]	Plates & Bars	C-Mn
1	2	ASTM A 441	—	K12211	>0.75 ≤1.5 [>19 ≤38]	67/46 [460/315]	Plates & Bars	C-Mn
1	2	ASTM A 441	—	K12211	>1.5 ≤4 [>38 ≤100]	63/41 [435/290]	Plates & Bars	C-Mn
1	2	ASTM A 441	—	K12211	>4 ≤8 [>100 ≤200]	60/40 [415/275]	Plates & Bars	C-Mn
1	2	ASTM A 441	Groups 1 & 2	—	—	70/50 [485/345]	Structural Shapes	C-Mn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	2	ASTM	A 441	Group 3	—	67/46 [460/315]	Structural Shapes	C-Mn
1	2	ASTM	A 441	Groups 4 & 5	—	63/42 [435/290]	Structural Shapes	C-Mn
1	2	ASTM	A 455	—	K03300	≤0.375 [10]	Plate	C-Mn
1	2	ASTM	A 455	—	K03300	>0.375 ≤0.580 [>10 ≤15]	Plate	C-Mn
1	2	ASTM	A 455		K03300	>0.580 ≤0.750 [>10 ≤19]	Plate	C-Mn
1	2	ASTM	A 487	Grade 16A	J31200	70/40 [483/276]	Castings	Low-C-Mn-Ni
1	2	ASTM	A 501	Grade B	—	70/50 [485/345]	Welded Tube	C
1	2	ASTM	A 508	Grade 1	K13502	70/36 [483/248]	Forging	C-Si
1	2	ASTM	A 508	Grade 1A	K13502	70/36 [483/248]	Forging	C-Mn-Si
1	2	ASTM	A 512	Grade 1030	G10300	75/55 [517/379]	Mechanical Tube	C
1	2	ASTM	A 513	Grade 1020 CW	G10200	62/45 [427/310]	Mechanical Tube	C
1	2	ASTM	A 513	Grade 1025 CW	G10250	62/45 [427/310]	Mechanical Tube	C
1	2	ASTM	A 513	Grade 1026	G10260	70/55 [483/379]	Mechanical Tube	C
1	2	ASTM	A 513	Grade 1030	G10300	75/55 [517/379]	Mechanical Tube	C
1	2	ASTM	A 515	Grade 70	K03101	70/38 [483/262]	Plate	C-Si
1	2	ASTM	A 516	Grade 70	K02700	70/38 [483/262]	Plate	C-Mn-Si
1	2	ASTM	A 519	Grade 1030	G10300	75/55 [517/379]	Mechanical Tube	C
1	2	ASTM	A 521	Class CE	—	75/37 [517/255]	Forging	C
1	2	ASTM	A 529	Grade 50	—	≤1.5 [38]	Shapes	1.35maxMn-0.27maxC
1	2	ASTM	A 529	Grade 50	—	<1.0 [25]	Plates	1.35maxMn-0.27maxC
1	2	ASTM	A 529	Grade 50	—	<3.5 [89]	Bars	1.35maxMn-0.27maxC
1	2	ASTM	A 529	Grade 55	—	≤1.5 [38]	Shapes	1.35maxMn-0.27maxC
1	2	ASTM	A 529	Grade 55	—	<1.0 [25]	Plates	1.35maxMn-0.27maxC
1	2	ASTM	A 529	Grade 55	—	<3.0 [75]	Bars	1.35maxMn-0.27maxC
1	2	ASTM	A 537	Class 1	K02400	≤2.5 [64]	Plate	C-Mn-Si
1	2	ASTM	A 537	Class 1	K02400	>2.5 ≤4.0 [≥64 ≤100]	Plate	C-Mn-Si
1	2	ASTM	A 541	Grade 1	K03506	70/36 [483/248]	Forging	C-Mn-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	2	ASTM A 541	Grade 1A	—	—	70/36 [483/248]	Forging	C-Mn-Si
1	2	ASTM A 556	Grade C2	K03006	—	70/40 [483/276]	Seamless Tube	C-Mn-Si
1	2	ASTM A 557	Grade C2	K03505	—	70/40 [483/276]	ERW Tube	C-Mn
1	2	ASTM A 572	Grade 55	—	—	70/55 [483/379]	Plate & Shapes	C-Mn-Si
1	2	ASTM A 573	Grade 70	K02701	—	70/42 [483/290]	Improved Toughness Plate	C-Mn-Si
1	2	ASTM A 588	Grade A	K11430	≤4 [100]	70/50 [483/345]		Plate & Bars
1	2	ASTM A 588	Grade A	K11430	>4.0 ≤5.0 >100 ≤125]	67/46 [462/317]	Plate & Bars	C-Mn-Ni-Cu-Cr-V
1	2	ASTM A 588	Grade A	K11430	>5.0 ≤8.0 (>125 ≤200]	63/42 [434/290]	Plate & Bars	C-Mn-Ni-Cu-Cr-V
1	2	ASTM A 588	Grade B	K12043	≤4 [100]	70/50 [483/345]	Plate & Bars	C-Mn-Ni-Cu-Cr-V
1	2	ASTM A 588	Grade B	K12043	>4.0 ≤5.0 >100 ≤125]	67/46 [462/317]	Plate & Bars	C-Mn-Ni-Cu-Cr-V
1	2	ASTM A 588	Grade B	K12043	>5.0 ≤8.0 >125 ≤200]	63/42 [434/290]	Plate & Bars	C-Mn-Ni-Cu-Cr-V
1	2	ASTM A 588	Grade C	K11538	≤4 [100]	70/50 [483/345]	Plate & Bars	C-Mn-Ni-Cu-Cr-V
1	2	ASTM A 588	Grade C	K11538	>4.0 ≤5.0 >100 ≤125]	67/46 [462/317]	Plate & Bars	C-Mn-Ni-Cu-Cr-V
1	2	ASTM A 588	Grade C	K11538	>5.0 ≤8.0 (>125 ≤200]	63/42 [434/290]	Plate & Bars	C-Mn-Ni-Cu-Cr-V
1	2	ASTM A 588	Grade K	—	≤4 [100]	70/50 [483/345]	Plate & Bars	C-Mn-Ni-Cu-Cr-Cb
1	2	ASTM A 588	Grade K	—	>4.0 ≤5.0 >100 ≤125]	67/46 [462/317]	Plate & Bars	C-Mn-Ni-Cu-Cr-Cb
1	2	ASTM A 588	Grade K	—	>5.0 ≤8.0 (>125 ≤200]	63/42 [434/290]	Plate & Bars	C-Mn-Ni-Cu-Cr-Cb
1	2	ASTM A 588	All Grades	—	—	70/50 [483/345]	Structural Shapes	C-Mn-Ni-Cu-Cr-Cb
1	2	ASTM A 595	Grade A	K02004	—	65/55 [448/379]	Tapered Tube	C-Mn
1	2	ASTM A 595	Grade B	K02005	—	70/60 [483/414]	Tapered Tube	C-Mn
1	2	ASTM A 606	Annealed or Norm	—	—	65/45 [448/310]	Hot Rolled Sheet & Strip	C-Mn
1	2	ASTM A 606	As Rolled	—	—	70/50 [483/345]	Hot Rolled Sheet & Strip	C-Mn
1	2	ASTM A 606	As Rolled	—	—	65/45 [448/310]	Cold Rolled Sheet & Strip	C-Mn
1	2	ASTM A 607	Grade 45	—	—	60/45 [414/310]	Sheet & Strip	C-Mn-Cb-V
1	2	ASTM A 618	Grade 1a	—	≤0.75 [19]	70/50 [483/345]	HSLA Tube	C-Mn
1	2	ASTM A 618	Grade 1a	—	>0.75 ≤1.5 >19 ≤38]	67/46 [462/317]	HSLA Tube	C-Mn
1	2	ASTM A 618	Grade 1b	K02601	≤0.75 [19]	70/50 [483/345]	HSLA Tube	C-Mn-Cu
1	2	ASTM A 618	Grade 1b	K02601	>0.75 ≤1.5 >19 ≤38]	67/46 [462/317]	HSLA Tube	C-Mn-Cu
1	2	ASTM A 618	Grade II	K12609	≤0.75 [19]	70/50 [483/345]	Tube	Mn-Cu-V

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form		Nominal Composition
Steel and Steel Alloys									
1	2	ASTM	A 618	Grade II	K12609	>0.75 ≤1.5 [$>19 \leq 38$]	70/50 [483/345]	Tube	Mn-Cu-V
1	2	ASTM	A 633	Grade C	K12000	≤2.5 [64]	70/50 [483/345]	HSLA Steel	C-Mn-Si-Cb
1	2	ASTM	A 633	Grade C	K12000	>2.5 ≤4.0 [$>64 \leq 100$]	65/46 [448/317]	HSLA Steel	C-Mn-Si-Cb
1	2	ASTM	A 633	Grade D	K12037	≤2.5 [64]	70/50 [483/345]	HSLA Steel	C-Mn-Si
1	2	ASTM	A 633	Grade D	K12037	>2.5 ≤4.0 [$>64 \leq 100$]	65/46 [448/317]	HSLA Steel	C-Mn-Si
1	2	ASTM	A 656	Grade 70	K11804	≤1 [25]	80/70 [552/483]	Hi-Str. Lo-Alloy Plate	1.65maxMn-0.6Si-0.18maxC
1	2	ASTM	A 660	Grade WCB	J03003	—	70/36 [483/248]	Centrifugal Cast Pipe	C-Si
1	2	ASTM	A 660	Grade WCC	J02505	—	70/40 [483/276]	Centrifugal Cast Pipe	C-Si
1	2	ASTM	A 662	Grade C	K02007	—	70/43 [483/296]	Plate	C-Mn-Si
1	2	ASTM	A 668	Class D	G10300	—	75/37.5 [517/259]	Forging	C-Mn
1	2	ASTM	A 671	Grade CB70	K03101	—	70/38 [483/262]	Fusion Welded Pipe	C-Si
1	2	ASTM	A 671	Grade CC70	K02700	—	70/38 [483/262]	Fusion Welded Pipe	C-Mn-Si
1	2	ASTM	A 671	Grade CD70	K02400	—	70/50 [483/345]	Fusion Welded Pipe	C-Mn-Si
1	2	ASTM	A 671	Grade CK75	K02803	—	75/40 [517/276]	Fusion Welded Pipe	C-Mn-Si
1	2	ASTM	A 672	Grade B70	K03101	—	70/38 [483/262]	Fusion Welded Pipe	C-Si
1	2	ASTM	A 672	Grade C70	K02700	—	70/38 [483/262]	Fusion Welded Pipe	C-Mn-Si
1	2	ASTM	A 672	Grade D70	K02400	—	70/50 [483/345]	Fusion Welded Pipe	C-Mn-Si
1	2	ASTM	A 672	Grade N75	K02803	—	75/40 [517/276]	Fusion Welded Pipe	C-Mn-Si
1	2	ASTM	A 675	Grade 70	—	—	70/35 [483/241]	Bar	C
1	2	ASTM	A 675	Grade 75	—	—	75/37.5 [517/259]	Bar	C
1	2	ASTM	A 678	Grade B	K02002	≤2.5 [64]	80/60 [552/414]	Structural Plate	1.0Mn-0.33Si ($>1.5=1.3\text{Mn}-0.33\text{Si}$)
1	2	ASTM	A 678	Grade A	K01600	≤1.5 [38]	70/50 [483/345]	Structural Plate	1.2Mn-0.33Si
1	2	ASTM	A 690	—	K12249	≤4 [100]	70/50 [483/345]	Marine Piling—Plate & Bar	0.75Mn-0.58Ni-0.12P
1	2	ASTM	A 691	Grade CMSH-70	K02400	—	70/50 [483/345]	Fusion Welded Pipe	C-Mn-Si
1	2	ASTM	A 691	Grade CMS-75	K02803	—	75/40 [517/276]	Fusion Welded Pipe	C-Mn-Si
1	2	ASTM	A 695	Type B, Grade 40	K03504	—	70/40 [483/276]	Bar	C-Mn-Si
1	2	ASTM	A 696	Grade C	K03200	—	70/40 [483/276]	Bar	C
1	2	ASTM	A 707	Grade L1, Class 2	K02302	—	66/52 [455/359]	Forging	C-1Mn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
1	2	ASTM	A 707	Grade L2, Class 2	K03301	—	66/52 [455/359]	Forging	C-Mn
1	2	ASTM	A 707	Grade L3, Class 2	K12510	—	66/52 [455/359]	Forging	1.3Mn-V-N
1	2	ASTM	A 707	Grade L4, Class 3	K12089	—	75/60 [517/414]	Forging	1.8Ni-0.55Mn-0.25Mo
1	2	ASTM	A 707	Grade L4, Class 2	K12089	—	66/52 [455/359]	Forging	1.8Ni-0.55Mn-0.25Mo
1	2	ASTM	A 707	Grade L5, Class 2	K20934	—	66/55 [455/379]	Forging	1.2Cu-0.9Ni-0.7Cr-0.5Mn
1	2	ASTM	A 709	Grade 50W	—	—	70/50 [483/345]	Plate, Bars, & Shapes	C-Mn-Cr-Si
1	2	ASTM	A 737	Grade B	K12001	—	70/50 [483/345]	Plate	C-Mn-Si-Cb
1	2	ASTM	A 738	Grade A	K12447	—	75/45 [417/310]	Plate	C-Mn-Si
1	2	ASTM	A 765	Grade II	K03047	—	70/36 [483/248]	Forging	C-Mn-Si
1	2	ASTM	A 913	Grade 50	—	—	65/50 [448/345]	Structural	C-Mn
1	2	ASTM	A 935	Grade 55 Class 1	—	—	70/55 [483/379]	Sheet & Strip	—
1	2	ASTM	A 935	Grade 55, Class 2	—	—	65/55 [448/379]	Sheet & Strip	C-Mn-Cb-V
1	2	ASTM	A 935	Grade 60, Class 1	—	—	75/60 [517/414]	Sheet & Strip	C-Mn-Cb-V
1	2	ASTM	A 935	Grade 60, Class 2	—	—	70/60 [483/414]	Sheet & Strip	C-Mn-Cb-V
1	2	ASTM	A 984	Grade 45	—	—	65/45 [448/310]	Line Pipe	C
1	2	ASTM	A 984	Grade 55	—	—	70/55 [483/379]	Line Pipe	C
1	2	ASTM	A 984	Grade 65	—	—	75/65 [517/448]	Line Pipe	C
1	2	ASTM	A 1008	HSLAS Grade 55 cl 1	—	—	70/55 [480/380]	Sheet & Strip	C
1	2	ASTM	A 1011	SS Grade 55	—	—	70/55 [483/379]	Sheet & Strip	—
1	2	ASTM	A 1011	HSLAS Grade 55 cl 1	—	—	70/55 [483/379]	Sheet & Strip	—
1	2	ASTM	A 1011	HSLAS Grade 60 cl 2	—	—	70/60 [483/414]	Sheet & Strip	—
1	2	ASTM	A 1018	HSLAS Grade SS cl 1	—	—	70/55 [480/380]	Sheet & Strip	C
1	2	ABS	ABS	Grade AH36	K11852	—	71/51 [490/352]	High Strength Hull Structural Steel	C-Mn-Si
1	2	ABS	ABS	Grade DH36	K11852	—	71/51 [490/352]	High Strength Hull Structural Steel	C-Mn-Si
1	2	ABS	ABS	Grade EH36	K11852	—	71/51 [490/352]	High Strength Hull Structural Steel	C-Mn-Si
1	2	ABS	ABS	Grade FH36	K11852	—	71/51 [490/352]	High Strength Hull Structural Steel	C-Mn-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	2	API	2H	Grade 50	—	70/50 [483/345]	Structural	C-Mn-Si
1	2	API	5L	Grade X52	—	66/52 [455/359]	Pipe	C-Mn
1	2	API	5L	Grade X56	—	71/56 [490/386]	Pipe	C-Mn-Cb-V-Ti
1	2	API	5L	Grade X60	—	75/60 [517/414]	Pipe	C-Mn-Cb-V-Ti
1	2	API	2Y	Grade 50T	—	70/50 [483/345]	Pipe	—
1	2	AS	1548	5-490	≤0.625 [16]	71/52 [490/359]	Plate	C
1	2	AS	1548	5-490	>0.625 ≤1.56 [>16 ≤40]	71/49 [490/338]	Plate	C
1	2	AS	1548	5-490	>1.56 ≤3.125 [>40 ≤78]	71/48 [490/331]	Plate	C
1	2	AS	1548	5-490	>3.125 ≤6 [>78 ≤150]	71/46 [490/317]	Plate	C
1	2	AS	1548	7-460	≤0.625 [16]	67/44 [462/303]	Plate	C
1	2	AS	1548	7-460	>0.625 ≤1.56 [>16 ≤40]	67/43 [462/296]	Plate	C
1	2	AS	1548	7-460	>1.56 ≤3.125 [>40 ≤78]	67/40 [462/276]	Plate	C
1	2	AS	1548	7-460	>3.125 ≤6 [>78 ≤150]	67/38 [462/262]	Plate	C
1	2	AS	1548	7-490	≤0.625 [16]	71/46 [490/317]	Plate	C
1	2	AS	1548	7-490	>0.625 ≤1.56 [>16 ≤40]	71/45 [490/310]	Plate	C
1	2	AS	1548	7-490	>1.56 ≤3.125 [>40 ≤78]	71/44 [490/303]	Plate	C
1	2	AS	1548	7-490	>3.125 ≤6 [>78 ≤150]	71/41 [490/283]	Plate	C
1	2	AS/NZS	3678	300/300L15	≤0.31 [8]	62/46 [427/317]	Plate	C-Mn
1	2	AS/NZS	3678	300/300L15	>0.31 ≤0.5 [>8 ≤13]	62/45 [427/310]	Plate	C-Mn
1	2	AS/NZS	3678	300/300L15	>0.5 ≤0.75 [>13 ≤19]	62/44 [427/303]	Plate	C-Mn
1	2	AS/NZS	3678	300/300L15	>0.75 ≤2 [>19 ≤50]	62/41 [427/283]	Plate	C-Mn
1	2	AS/NZS	3678	300/300L15	>2 ≤3.125 [>50 ≤78]	62/39 [427/269]	Plate	C-Mn
1	2	AS/NZS	3678	300/300L15	>3.125 ≤6 [>78 ≤150]	62/38 [427/262]	Plate	C-Mn
1	2	AS/NZS	3678	350/350L15	≤0.5 [13]	65/52 [448/359]	Plate	C-Mn
1	2	AS/NZS	3678	350/350L15	>0.5 ≤0.75 [>13 ≤19]	65/51 [448/352]	Plate	C-Mn
1	2	AS/NZS	3678	350/350L15	>0.75 ≤3.125 [>19 ≤78]	65/49 [448/338]	Plate	C-Mn
1	2	AS/NZS	3678	350/350L15	>3.125 ≤6 [>78 ≤150]	65/48 [448/331]	Plate	C-Mn
1	2	AS/NZS	3678	400/400L15	≤0.5 [13]	70/58 [483/400]	Plate	C-Mn
1	2	AS/NZS	3678	400/400L15	>0.5 ≤0.75 [>13 ≤19]	70/55 [483/379]	Plate	C-Mn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	2	AS/NZS 3678	400/400L15	—	>0.75 ≤3.125 >19 ≤78]	70/52 [483/359]	Plate	C-Mn
1	2	AS/NZS 3678	400/400L15	—	≤0.75 [19]	75/65 [517/448]	Plate	C-Mn
1	2	AS/NZS 3678	400/400L15	—	>0.75 ≤1.25 >19 ≤29]	73/61 [503/421]	Plate	C-Mn
1	2	AS/NZS 3678	400/400L15	—	>1.25 ≤2 >29 ≤50]	73/58 [503/400]	Plate	C-Mn
1	2	AS/NZS 3679.1	300/300L0/300L15	—	<0.44 [11]	64/46 [441/317]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	300/300L0/300L15	—	≥0.44 <0.625 [≥11 <16]	64/44 [441/303]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	300/300L0/300L15	—	≥0.625 ≥1.56 [≥16 ≥40]	64/41 [441/283]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	300/300L0/300L15	—	≤2 [50]	64/44 [441/303]	Hex, Squares & Rounds	C-Mn
1	2	AS/NZS 3679.1	300/300L0/300L15	—	>2 <4 >50 <100]	64/42 [441/290]	Hex, Squares & Rounds	C-Mn
1	2	AS/NZS 3679.1	300/300L0/300L15	—	≥4 [100]	64/41 [441/283]	Hex, Squares & Rounds	C-Mn
1	2	AS/NZS 3679.1	350/350L0/350L15	—	<0.44 [11]	70/52 [483/359]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	350/350L0/350L15	—	≥0.44 <0.625 [≥11 <16]	70/49 [483/338]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	350/350L0/350L15	—	≥0.625 <1.56 [≥16 <40]	70/49 [483/338]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	350/350L0/350L15	—	≤1.56 [40]	70/48 [483/331]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	350/350L0/350L15	—	≤2 [50]	70/49 [483/338]	Hex, Squares & Rounds	C-Mn
1	2	AS/NZS 3679.1	350/350L0/350L15	—	>2 <4 >50 <100]	70/48 [483/331]	Hex, Squares & Rounds	C-Mn
1	2	AS/NZS 3679.1	350/350L0/350L15	—	≥4 [100]	70/46 [483/317]	Hex, Squares & Rounds	C-Mn
1	2	AS/NZS 3679.1	400/400L0/400L15	—	<0.44 [11]	75/58 [517/400]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	400/400L0/400L15	—	≥0.44 <0.625 [≥11 <16]	75/58 [517/400]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	400/400L0/400L15	—	≥0.625 <1.56 [≥16 <40]	75/55 [517/379]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	400/400L0/400L15	—	≤1.56 [40]	75/55 [517/379]	Flats & Sections	C-Mn
1	2	AS/NZS 3679.1	400/400L0/400L15	—	≤2 [50]	75/58 [517/400]	Hex, Squares & Rounds	C-Mn
1	2	AS/NZS 3679.1	400/400L0/400L15	—	>2 <4 >50 <100]	75/55 [517/379]	Hex, Squares & Rounds	C-Mn
1	2	AS/NZS 3679.1	400/400L0/400L15	—	≥4 [100]	75/52 [517/359]	Hex, Squares & Rounds	C-Mn
1	2	CSA G40.20/40.21	350A	—	—	70/50 [483/345]	HSLA Steel	C-Mn
1	2	CSA G40.20/40.21	350AT	—	—	70/50 [483/345]	HSLA Steel	C-Mn
1	2	CSA G40.20/40.21	350R	—	—	70/50 [483/345]	HSLA Steel	C-Mn
1	2	CSA G40.20/40.21	350W	—	—	65/50 [448/345]	Structural	C-Mn
1	2	CSA G40.20/40.21	350WT	—	—	70/50 [483/345]	Structural	C-Mn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	2	CSA	G40.20/40.21	380W	—	70/55 [483/379]	Structural	C-Mn-Si-Cb-V
1	2	CSA	G40.20/40.21	380WT	—	70/55 [483/379]	Structural	C-Mn-Si-Cb-V
1	2	CSA	G40.20/40.21	400A	—	75/60 [517/414]	HSLA Steel	C-Mn-Si-Cb-V
1	2	CSA	G40.20/40.21	400AT	—	75/60 [517/414]	HSLA Steel	C-Mn-Si-Cb-V
1	2	CSA	G40.20/40.21	400W	—	75/60 [517/414]	HSLA Steel	C-Mn-Si-Cb-V
1	2	CSA	G40.20/40.21	400WT	—	75/60 [517/414]	HSLA Steel	C-Mn-Si-Cb-V
1	2	CSA	G40.20/40.21	550A	—	90/80 [621/552]	Structural Steel	C-Mn-Si-Cb-V
1	2	CSA	G40.20/40.21	550AT	—	90/80 [621/552]	Structural Steel	C-Mn-Si-Cb-V
1	2	CSA	G40.20/40.21	550W	—	90/80 [621/552]	Structural Steel	C-Mn-Si-Cb-V
1	2	CSA	G40.20/40.21	550WT	—	90/80 [621/552]	Structural Steel	C-Mn-Si-Cb-V
1	2	CSA	Z245.1	317	—	63/46 [434/317]	Pipe	C-Mn
1	2	CSA	Z245.1	359	—	66/52 [455/359]	Pipe	C-Mn
1	2	CSA	Z245.1	386	—	71/56 [490/386]	Pipe	C-Mn
1	2	CSA	Z245.11	317	—	63/46 [434/317]	Steel Fittings	C-Mn-Si
1	2	CSA	Z245.11	359	—	66/52 [455/359]	Steel Fittings	C-Mn-Si
1	2	CSA	Z245.11	386	—	71/56 [490/386]	Steel Fittings	C-Mn-Si
1	2	CSA	Z245.12	317	—	63/46 [434/317]	Steel Flanges	C-Mn-Si
1	2	CSA	Z245.12	359	—	66/52 [455/359]	Steel Flanges	C-Mn-Si
1	2	CSA	Z245.12	386	—	71/56 [490/386]	Steel Flanges	C-Mn-Si
1	2	MSS	SP75	WPHY-56	—	71/56 [490/386]	Seamless & Welded Fittings	C-Mn
1	2	MSS	SP75	WPHY-60	—	75/60 [517/414]	Seamless & Welded Fittings	C-Mn
1	2	MSS	SP75	WPHY-65	—	77/65 [531/448]	Seamless & Welded Fittings	C-Mn
1	3	ASTM	A 333	Grade 10	—	80/65 [552/448]	Pipe	C-Mn-Si-V-Cb
1	3	ASTM	A 350	Grade LF6, Class 2	K12202	75/60 [517/414]	Forging	1.3Mn-Si-V-N
1	3	ASTM	A 350	Grade LF6, Class 3	K12202	75/60 [517/414]	Forging	1.3Mn-Si-V-N
1	3	ASTM	A 537	Class 2	K02400	≤2.5 [64]	Plate	C-Mn-Si
1	3	ASTM	A 537	Class 2	K02400	>2.5 ≤4.0 [≥64 ≤100]	Plate	C-Mn-Si
1	3	ASTM	A 537	Class 2	K02400	>4.0 ≤6.0 [≥100 ≤150]	Plate	C-Mn-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	3	ASTM A 537	Class 3	K02400	≤2.5 [64]	80/55 [552/379]	Plate	C-Mn-Si
1	3	ASTM A 537	Class 3	K02400	>2.5 ≤4.0 [>64 ≤100]	75/50 [517/345]	Plate	C-Mn-Si
1	3	ASTM A 537	Class 3	K02400	>4.0 ≤6.0 [>100 ≤150]	70/40 [483/276]	Plate	C-Mn-Si
1	3	ASTM A 572	Grade 60	K02305	—	75/60 [517/414]	Plate & Bars	C-Mn-Si-Cb-V
1	3	ASTM A 572	Grade 65	K02306	—	80/65 [552/448]	Shapes	C-Mn-Si-Cb-V
1	3	ASTM A 607	Grade 60	—	—	75/60 [517/414]	Sheet & Strip	C-Mn-Cb-V
1	3	ASTM A 607	Grade 65	—	—	80/65 [552/448]	Sheet & Strip	C-Mn-Cb-V
1	3	ASTM A 607	Grade 70	—	—	85/70 [586/483]	Sheet & Strip	C-Mn-Cb-V
1	3	ASTM A 611	Grade E	G10170	—	82/80 [565/552]	Sheet & Strip	C-Mn
1	3	ASTM A 633	Grade E	K12202	≤4.0 [100]	80/60 [552/414]	HSLA Steel	C-Mn-Si-N
1	3	ASTM A 633	Grade E	K12202	>4.0 ≤6.0 [>100 ≤150]	75/55 [517/379]	HSLA Steel	C-Mn-Si-N
1	3	ASTM A 656	Grade 80	K11804	≤0.75 [19]	90/80 [621/552]	Hi-Str. Lo-Alloy Plate	1.65maxMn-0.6Si-0.18maxC
1	3	ASTM A 663	Grade 70	—	—	70/39 [483/26]	Flat, Round, Square & Hex. Bar & Shapes	C
1	3	ASTM A 663	Grade 75	—	—	75/41 [517/283]	Flat, Round, Square & Hex. Bar & Shapes	C
1	3	ASTM A 663	Grade 80	—	—	80/44 [552/303]	Flat, Round, Square & Hex. Bar & Shapes	C
1	3	ASTM A 668	Class F	—	≤4.0 [100]	90/55 [621/379]	Forging	C-Mn
1	3	ASTM A 668	Class F	—	>4.0 ≤10.0 [>100 ≤250]	85/50 [586/345]	Forging	C-Mn
1	3	ASTM A 668	Class F	—	>10.0 ≤20.0 [>250 ≤500]	82/48 [565/331]	Forging	C-Mn
1	3	ASTM A 671	Grade CD80	K02400	—	80/60 [552/414]	Fusion Welded Pipe	C-Mn-Si
1	3	ASTM A 672	Grade D80	K02400	—	80/65 [552/448]	Fusion Welded Pipe	C-Mn-Si
1	3	ASTM A 678	Grade C	K02204	≤0.75 [19]	95/75 [655/517]	Structural-Plate	1.3Mn-0.35Si
1	3	ASTM A 678	Grade C	K02204	>0.75 ≤1.5 [>19 ≤38]	90/70 [621/483]	Structural-Plate	1.3Mn-0.35Si
1	3	ASTM A 678	Grade C	K02204	>1.5 ≤2.0 [>38 ≤50]	85/65 [586/448]	Structural-Plate	1.3Mn-0.35Si
1	3	ASTM A 678	Grade D	K12202	≤3 [75]	90/75 [621/517]	Structural-Plate	1.33Mn-0.33Si-0.75V-0.20N
1	3	ASTM A 691	Grade CMSH-80	K02400	—	80/60 [552/414]	Fusion Welded Pipe	C-Mn-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
1	3	ASTM	A 707	Grade L2, Class 3	K03301	—	75/60 [517/414]	Forging	C-Mn
1	3	ASTM	A 707	Grade L3, Class 3	K12510	—	75/60 [517/414]	Forging	1.3Mn-V-N
1	3	ASTM	A 707	Grade L5, Class 3	K20934	—	75/60 [517/414]	Forging	1.2Cu-0.9Ni-0.7Cr-0.5Mn
1	3	ASTM	A 710	Grade A, Class 3	K20747	≤2.00 [50]	85/75 [586/517]	Plate	Ni-Cu-Cr-Mo-Cb
1	3	ASTM	A 710	Grade A, Class 3	K20747	>2.00 ≤4.00 [50 ≤100]	75/65 [517/448]	Plate	Ni-Cu-Cr-Mo-Cb
1	3	ASTM	A 710	Grade A, Class 3	K20747	>4.00 [100]	70/60 [483/414]	Plate	Ni-Cu-Cr-Mo-Cb
1	3	ASTM	A 737	Grade C	K12202	—	80/60 [552/414]	Plate	C-Mn-Si-V
1	3	ASTM	A 738	Grade B	K12447	—	85/60 [586/414]	Plate	C-Mn-Si
1	3	ASTM	A 738	Grade C	—	≤2.5 [64]	80/60 [552/414]	Plate	C-Mn-Si
1	3	ASTM	A 738	Grade C	—	>2.500 ≤4.00 [64 ≤100]	75/55 [517/379]	Plate	C-Mn-Si
1	3	ASTM	A 738	Grade C	—	>4.0 ≤6.0 [100 ≤150]	70/46 [483/317]	Plate	C-Mn-Si
1	3	ASTM	A 765	Grade IV	K03046	—	80/50 [552/345]	Forging	C-Mn-Si
1	3	ASTM	A 913	Grade 60	—	—	75/60 [517/414]	Structural Shapes	C-Mn
1	3	ASTM	A 913	Grade 65	—	—	80/65 [552/448]	Structural Shapes	C-Mn
1	3	ASTM	A 935	Grade 65, Class 1	—	—	80/65 [552/448]	Sheet & Strip	C-Mn-Cb-V
1	3	ASTM	A 935	Grade 65, Class 2	—	—	75/65 [517/448]	Sheet & Strip	C-Mn-Cb-V
1	3	ASTM	A 935	Grade 70, Class 1	—	—	85/70 [586/483]	Sheet & Strip	C-Mn-Cb-V
1	3	ASTM	A 935	Grade 70, Class 2	—	—	80/70 [552/483]	Sheet & Strip	C-Mn-Cb-V
1	3	ASTM	A 1008	SS Grade 80	—	—	82/80 [565/552]	Sheet	—
1	3	ASTM	A 1008	HSLAS Grade 70 cl 2	—	—	80/70 [552/483]	Sheet	—
1	3	ASTM	A 1011	HSLAS Grade 60 cl 1	—	—	75/60 [517/414]	Sheet & Strip	—
1	3	ASTM	A 1011	HSLAS Grade 65 cl 1	—	—	80/65 [552/448]	Sheet & Strip	—
1	3	ASTM	A 1011	HSLAS Grade 65 cl 2	—	—	75/65 [517/448]	Sheet & Strip	—
1	3	ASTM	A 1018	HSLAS Grade 60 cl 1	—	—	70/60 [480/415]	Sheet & Strip	C
1	3	ASTM	A 1018	HSLAS Grade 70 cl 2	—	—	80/70 [550/480]	Sheet & Strip	C
1	3	ABS	Grade AH40	K11857	—	—	74/57 [510/393]	Ordinary Strength Hull Structural Steel	C-Mn-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	3	ABS	Grade DH40	K11857	—	74/57 [510/393]	Ordinary Strength Hull Structural Steel	C-Mn-Si
1	3	ABS	Grade EH40	K11857	—	74/57 [510/393]	Ordinary Strength Hull Structural Steel	C-Mn-Si
1	3	ABS	Grade FH40	K11857	—	74/57 [510/393]	Ordinary Strength Hull Structural Steel	C-Mn-Si
1	3	API	Grade X65	—	—	77/65 [531/448]	Pipe	C-Mn-Cb-V-Ti
1	3	API	Grade X70	—	—	82/70 [565/483]	Pipe	C-Mn-Cb-V-Ti
1	3	AS/NZS	XF500	—	—	83/70 [572/483]	Strip	C-Mn
1	3	CSA	480A	—	—	85/70 [586/483]	HSLA Steel	C-Mn-Si-Cb-V
1	3	CSA	480AT	—	—	85/70 [586/483]	HSLA Steel	C-Mn-Si-Cb-V
1	3	CSA	480W	—	—	85/70 [586/483]	HSLA Steel	C-Mn-Si-Cb-V
1	3	CSA	480WT	—	—	85/70 [586/483]	HSLA Steel	C-Mn-Si-Cb-V
1	3	CSA	414	—	—	75/60 [517/414]	Pipe	C-Mn
1	3	CSA	448	—	—	77/65 [531/448]	Pipe	C-Mn
1	3	CSA	483	—	—	82/70 [565/483]	Pipe	C-Mn
1	3	CSA	414	—	—	75/60 [517/414]	Steel Fittings	C-Mn-Si
1	3	CSA	448	—	—	77/65 [531/448]	Steel Fittings	C-Mn-Si
1	3	CSA	483	—	—	82/70 [565/483]	Steel Fittings	C-Mn-Si
1	3	CSA	414	—	—	75/60 [517/414]	Steel Flanges	C-Mn-Si
1	3	CSA	448	—	—	77/65 [531/448]	Steel Flanges	C-Mn-Si
1	3	CSA	483	—	—	82/70 [565/483]	Steel Flanges	C-Mn-Si
1	3	MSS	WP75	—	—	82/70 [565/483]	Seamless & Welded Fittings	C-Mn
1	4	ASTM	A 707	K20934	—	90/75 [621/517]	Forging	1.2Cu-0.9Ni-0.7Cr-0.5Mn
1	4	ASTM	A 724	K11831	—	90/70 [621/483]	Plate	C-Mn-Si
1	4	ASTM	A 724	K12031	—	95/75 [655/517]	Plate	C-Mn-Si
1	4	ASTM	A 724	K12037	—	90/70 [621/483]	Plate	C-Mn-Si
1	4	ASTM	A 913	Grade 70	—	90/70 [621/483]	Structural Shapes	1.6maxMn-0.16maxC

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
1	4	ASTM	A 935	Grade 70, Class 1	—	85/70 [586/483]	Sheet & Strip	C-Mn-Cb-V
1	4	ASTM	A 984	Grade 85	—	90/80 [621/552]	Line Pipe	C
1	4	ASTM	A 1008	HSLAS Grade 70 cl 1	—	85/70 [586/483]	Sheet	
1	4	ASTM	A 1011	HSLAS Grade 70 cl 1	—	85/70 [586/483]	Sheet & Strip	
1	4	ASTM	A 1011	HSLAS Grade 70 cl 2	—	80/70 [552/483]	Sheet & Strip	
1	4	API	5L	Grade X80	—	90/80 [621/552]	Pipe	C-Mn
1	4	CSA	Z245.1	550	—	90/80 [621/552]	Pipe	C-Mn
1	4	CSA	Z245.11	550	—	90/80 [621/552]	Steel Fittings	C-Mn-Si
1A	4	ASTM	A 615	Grade 40	—	60/40 [414/276]	Rebar	C
1A	4	ASTM	A 615	Grade 60	—	90/60 [621/414]	Rebar	C
1A	4	ASTM	A 706	—	K03011	80/60 [552/414]	Rebar	C
1A	4	CSA	G30.18	300R	—	60/40 [414/276]	Rebar	C
1A	4	CSA	G30.18	400R	—	80/50 [552/345]	Rebar	C
1A	4	CSA	G30.18	500R	—	90/60 [621/414]	Rebar	C
1A	4	CSA	G30.18	400W	—	80/60 [552/414]	Rebar	C
1A	4	CSA	G30.18	500W	—	90/70 [621/483]	Rebar	C
3	1	ASTM	A 161	Grade T1	K11522	55/30 [379/207]	Tube	C-Mo
3	1	ASTM	A 204	Grade A	K11820	65/37 [448/255]	Plate	C-0.5Mo
3	1	ASTM	A 209	Grade T1a	K12023	60/32 [414/221]	Seamless Tube	C-0.5Mo
3	1	ASTM	A 209	Grade T1b	K11422	53/28 [365/193]	Seamless Tube	C-0.5Mo
3	1	ASTM	A 209	Grade T1	K11522	55/30 [379/207]	Seamless Tube	C-0.5Mo
3	1	ASTM	A 213	Grade T2	K11547	60/30 [414/207]	Seamless Tube	0.5Cr-0.5Mo
3	1	ASTM	A 217	Grade WCl	J12524	65/35 [448/241]	Castings	C-0.5Mo
3	1	ASTM	A 234	Grade WP1	K12821	55/30 [379/207]	Pipe Fittings	C-0.5Mo
3	1	ASTM	A 250	Grade T1a	K12023	60/32 [414/221]	ERW Tube	C-0.5Mo
3	1	ASTM	A 250	Grade T2	K11547	60/30 [414/207]	ERW Tube	0.5Cr-0.5Mo
3	1	ASTM	A 250	Grade T1	K11522	55/30 [379/207]	ERW Tube	C-0.5Mo
3	1	ASTM	A 250	Grade T1b	K11422	53/28 [365/193]	ERW Tube	C-0.5Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
3	1	ASTM	A 335	Grade P1	K11522	—	Seamless Pipe	C-0.5Mo
3	1	ASTM	A 335	Grade P2	K11547	—	Seamless Pipe	0.5Cr-0.5Mo
3	1	ASTM	A 335	Grade P15	K11578	—	Seamless Pipe	1.5Si-0.5mo
3	1	ASTM	A 352	Grade LC1	J12522	—	Castings	C-0.5Mo
3	1	ASTM	A 369	Grade FP2	K11547	—	Pipe	0.5Cr-0.5Mo
3	1	ASTM	A 369	Grade FP1	K11522	—	Pipe	C-0.5Mo
3	1	ASTM	A 387	Grade 2, Class 1	K12143	—	Plate	0.5Cr-0.5Mo
3	1	ASTM	A 426	Grade CP1	J12521	—	Centrifugal Cast Pipe	C-0.5Mo
3	1	ASTM	A 426	Grade CP15	J11522	—	Centrifugal Cast Pipe	C-0.5Mo-Si
3	1	ASTM	A 426	Grade CP2	J11547	—	Centrifugal Cast Pipe	0.5Cr-0.5Mo
3	1	ASTM	A 595	Grade C	K11526	—	Tapered Tube	Mn-Ni-Cr-Cu-Cb
3	1	ASTM	A 672	Grade L65	K11820	—	Fusion Welded Pipe	C-0.5Mo
3	1	ASTM	A 691	Grade 1/2 CR, Class 1	K12143	—	Fusion Welded Pipe	0.5Cr-0.5Mo
3	1	ASTM	A 691	Grade CM-65	K11820	—	Fusion Welded Pipe	C-0.5Mo
3	1	ASTM	A 707	Grade L6, Class 1	K02902	—	Forging	2Mn-0.3Mo-Cb
3	1	ASTM	A 945	Grade 50	—	—	Plate	LowC-Mn
3	1	AS/NZS	3678	WR350/WR350L0	—	≤0.75 [19]	Plate	C-Mn-Cr-Ni-Cu
3	2	ASTM	A 182	Grade F1	K12822	—	Pipe Flanges & Fittings	C-0.5Mo
3	2	ASTM	A 182	Grade F2	K12122	—	Pipe Flanges & Fittings	0.5Cr-0.5Mo
3	2	ASTM	A 204	Grade B	K12020	—	Plate	C-0.5Mo
3	2	ASTM	A 204	Grade C	K12320	—	Plate	C-0.5Mo
3	2	ASTM	A 302	Grade A	K12021	—	Plate	Mn-0.5Mo
3	2	ASTM	A 336	Grade F1	K12520	—	Forging	C-0.5Mo
3	2	ASTM	A 387	Grade 2, Class 2	K12143	—	Plate	0.5Cr-0.5Mo
3	2	ASTM	A 672	Grade H75	K12021	—	Fusion Welded Pipe	Mn-0.5Mo
3	2	ASTM	A 672	Grade L70	K12020	—	Fusion Welded Pipe	C-0.5Mo
3	2	ASTM	A 672	Grade L75	K12320	—	Fusion Welded Pipe	C-0.5Mo
3	2	ASTM	A 691	Grade CM-70	K12020	—	Fusion Welded Pipe	C-0.5Mo
3	2	ASTM	A 691	Grade CM-75	K12320	—	Fusion Welded Pipe	C-0.5Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
3	2	ASTM	A 691	Grade 1/2 CR, Class 2	K12143	70/45 [483/310]	Fusion Welded Pipe	0.5Cr-0.5Mo
3	2	ASTM	A 871	Grade 60	—	75/60 [517/414]	Plate	C-Mn-Ni-Cu-Cr-V
3	2	ASTM	A 707	Grade L6, Class 2	K02902	66/52 [455/359]	Forging	2Mn-0.3Mo-Cb
3	2	ASTM	A 945	Grade 65	—	78/65 [538/448]	Plate	LowC-Mn
3	3	ASTM	A 302	Grade B	K12022	80/50 [552/345]	Plate & Sheet	Mn-0.5Mo
3	3	ASTM	A 302	Grade C	K12039	80/50 [552/345]	Plate & Sheet	Mn-0.5Mo-0.5Ni
3	3	ASTM	A 302	Grade D	K12054	80/50 [552/345]	Plate & Sheet	Mn-0.5Mo-0.75Ni
3	3	ASTM	A 487	Grade 4, Class C	J13047	90/60 [621/414]	Castings	0.5Ni-0.5Cr-0.25Mo-V
3	3	ASTM	A 508	Grade 2, Class 1	K12766	80/50 [552/345]	Forging	0.75Ni-0.5Mo-0.3Cr-V
3	3	ASTM	A 508	Grade 2, Class 2	K12766	90/65 [621/448]	Forging	0.75Ni-0.5Mo-0.3Cr-V
3	3	ASTM	A 508	Grade 3, Class 1	K12042	80/50 [552/345]	Forging	0.75Ni-0.5Mo-Cr-V
3	3	ASTM	A 508	Grade 3, Class 2	K12042	90/65 [621/448]	Forging	0.75Ni-0.5Mo-Cr-V
3	3	ASTM	A 508	Grade 4N, Class 3	K22375	90/70 [621/483]	Forging	2.75Cr-2.5Ni-0.5Mo-V
3	3	ASTM	A 533	Type A, Class 1	K12521	80/50 [552/345]	Plate	Mn-0.5Mo
3	3	ASTM	A 533	Type A, Class 2	K12521	90/70 [621/483]	Plate	Mn-0.5Mo
3	3	ASTM	A 533	Type B, Class 1	K12539	80/50 [552/345]	Plate	Mn-0.5Mo-0.5Ni
3	3	ASTM	A 533	Type B, Class 2	K12539	90/70 [621/483]	Plate	Mn-0.5Mo-0.5Ni
3	3	ASTM	A 533	Type C, Class 1	K12554	80/50 [552/345]	Plate	Mn-0.5Mo-0.75Ni
3	3	ASTM	A 533	Type C, Class 2	K12554	90/70 [621/483]	Plate	Mn-0.5Mo-0.75Ni
3	3	ASTM	A 533	Type D, Class 1	K12529	80/50 [552/345]	Plate	Mn-0.5Mo-0.25Ni
3	3	ASTM	A 533	Type D, Class 2	K12529	90/70 [621/483]	Plate	Mn-0.5Mo-0.25Ni
3	3	ASTM	A 541	Grade 2, Class 1	K12765	80/50 [552/345]	Forging	0.75Ni-0.5Mo-0.3Cr-V
3	3	ASTM	A 541	Grade 2, Class 2	K12765	90/65 [621/448]	Forging	0.75Ni-0.5Mo-0.3Cr-V
3	3	ASTM	A 541	Grade 3, Class 1	K12045	80/50 [552/345]	Forging	0.5Ni-0.5Mo-V
3	3	ASTM	A 541	Grade 3, Class 2	K12045	90/65 [621/448]	Forging	0.5Ni-0.5Mo-V
3	3	ASTM	A 672	Grade J80	K12554	80/50 [552/345]	Fusion Welded Pipe	Mn-0.5Mo-0.75Ni
3	3	ASTM	A 672	Grade J90	K12554	90/70 [621/483]	Fusion Welded Pipe	Mn-0.5Mo-0.75Ni
3	3	ASTM	A 672	Grade H80	K12022	80/50 [552/345]	Fusion Welded Pipe	Mn-0.5Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
3	3	ASTM	A 707	Grade L6, Class 3	K02902	—	Forging	2Mn-0.3Mo-Cb
3	3	ASTM	A 871	Grade 65	—	75/60 [517/414] 80/65 [552/448]	Plate	C-Mn-Ni-Cu-Cr-V
3	4	ASTM	A 707	Grade L6, Class 4	K02902	—	Forging	2Mn-0.3Mo-Cb
4	1	ASTM	A 182	Grade F11, Class 1	K11597	—	Pipe Flanges & Fittings	1.25Cr-0.5Mo-Si
4	1	ASTM	A 182	Grade F11, Class 2	K11572	—	Pipe Flanges & Fittings	1.25Cr-0.5Mo-Si
4	1	ASTM	A 182	Grade F11, Class 3	K11572	—	Pipe Flanges & Fittings	1.25Cr-0.5Mo-Si
4	1	ASTM	A 182	Grade F12, Class 1	K11562	—	Pipe Flanges & Fittings	1Cr-0.5Mo
4	1	ASTM	A 182	Grade F12, Class 2	K11564	—	Pipe Flanges & Fittings	1Cr-0.5Mo
4	1	ASTM	A 199	Grade T11	K11597	—	Seamless Tube	1.25Cr-0.5Mo
4	1	ASTM	A 202	Grade A	K11742	—	Plate	0.5Cr-1.25Mn-Si
4	1	ASTM	A 202	Grade B	K12542	—	Plate	0.5Cr-1.25Mn-Si
4	1	ASTM	A 213	Grade T11	K11597	—	Seamless Tube	1.25Cr-0.5Mo-Si
4	1	ASTM	A 213	Grade T12	K11562	—	Seamless Tube	1Cr-0.5Mo
4	1	ASTM	A 217	Grade WC4	J12082	—	Castings	1Ni-Cr-0.5Mo
4	1	ASTM	A 217	Grade WC5	J22000	—	Castings	0.75Ni-Mo-0.75Cr
4	1	ASTM	A 217	Grade WC6	J12072	—	Castings	1.25Cr-0.5Mo
4	1	ASTM	A 234	Grade WP11, Class 1	—	—	Pipe Fittings	1.25Cr-0.5Mo-Si
4	1	ASTM	A 234	Grade WP12, Class 1	K12062	—	Pipe Fittings	1Cr-0.5Mo
4	1	ASTM	A 250	Grade T11	K11597	—	ERW Tube	1.25Cr-0.5Mo-Si
4	1	ASTM	A 335	Grade P11	K11597	—	Pipe	1.25Cr-0.5Mo-Si
4	1	ASTM	A 335	Grade P12	K11562	—	Pipe	1Cr-0.5Mo
4	1	ASTM	A 336	Grade F11, Class 1	K11597	—	Forging	1.25Cr-0.5Mo-Si
4	1	ASTM	A 336	Grade F11, Class 2	K11572	—	Forging	1.25Cr-0.5Mo-Si
4	1	ASTM	A 336	Grade F11, Class 3	K11572	—	Forging	1.25Cr-0.5Mo-Si
4	1	ASTM	A 336	Grade F12	K11564	—	Forging	1Cr-0.5Mo
4	1	ASTM	A 369	Grade FP11	K11597	—	Forged Pipe	1.25Cr-Mo-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
4	1	ASTM	A 369	Grade FP12	K11562	—	Forged Pipe	1Cr-0.5Mo
4	1	ASTM	A 387	Grade 11, Class 1	K11789	—	Plate	1.25Cr-0.5Mo-Si
4	1	ASTM	A 387	Grade 11, Class 2	K11789	—	Plate	1.25Cr-0.5Mo-Si
4	1	ASTM	A 387	Grade 12, Class 1	K11757	—	Plate	1Cr-0.5Mo
4	1	ASTM	A 387	Grade 12, Class 2	K11757	—	Plate	1Cr-0.5Mo
4	1	ASTM	A 389	Grade C23	J12080	—	Castings	1.25Cr-0.5Mo-V
4	1	ASTM	A 389	Grade C24	J12092	—	Castings	1Cr-1Mo-V
4	1	ASTM	A 405	Grade P24	K11591	—	Cast Pipe	1.25Cr-Mo
4	1	ASTM	A 426	Grade CP11	J12072	—	Cast Pipe	1.25Cr-0.5Mo-0.5Mn
4	1	ASTM	A 426	Grade CP12	J11562	—	Cast Pipe	1.25Cr-0.5Mo-0.5Mn
4	1	ASTM	A 541	Grade 11, Class 4	K11572	—	Forging	1.25Cr-0.5Mo-Si
4	1	ASTM	A 691	Grade 1CR, Class 1	K11757	—	Fusion Welded Pipe	1.25Cr-0.5Mo-Si
4	1	ASTM	A 691	Grade 1CR, Class 2	K11789	—	Fusion Welded Pipe	1.25Cr-0.5Mo-Si
4	1	ASTM	A 691	Grade 1.25CR, Class 1	K11757	—	Fusion Welded Pipe	1Cr-0.5Mo
4	1	ASTM	A 691	Grade 1.25CR, Class 2	K11789	—	Fusion Welded Pipe	1Cr-0.5Mo
4	1	ASTM	A 739	Grade B11	K11797	—	Bar	1.25Cr-0.5Mo
4	2	ASTM	A 234	Grade WP11, Class 2	—	—	Pipe Fittings	1.25Cr-0.5Mo-Si
4	2	ASTM	A 234	Grade WP11, Class 3	—	—	Pipe Fittings	1.25Cr-0.5Mo-Si
4	2	ASTM	A 234	Grade WP12, Class 2	K12062	—	Pipe Fittings	1Cr-0.5Mo
4	2	ASTM	A 333	Grade 4	K11267	—	Pipe	0.75Cr-0.75Ni-Cu-Al
4	2	ASTM	A 423	Grade 1	K11535	—	Tube	0.75Cr-0.5Ni-Cu
4	2	ASTM	A 423	Grade 2	K11540	—	Tube	0.75Ni-0.5Cu-Mo
4	3	ASTM	A 148	Grade 90-60	—	—	Castings	C
5A	1	ASTM	A 182	Grade F21	K31545	—	Pipe Flanges & Fittings	3Cr-1Mo
5A	1	ASTM	A 182	Grade F22, Class 1	K21590	—	Pipe Flanges & Fittings	2.25Cr-1Mo
5A	1	ASTM	A 182	Grade F22, Class 3	K21590	—	Pipe Flanges & Fittings	2.25Cr-1Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
5A 1	ASTM	A 199	Grade T4	K31509	—	60/25 [414/172]	Seamless Tube	2.25Cr-0.5Mo-0.75Si
5A 1	ASTM	A 199	Grade T21	K31545	—	60/25 [414/172]	Seamless Tube	3Cr-1Mo
5A 1	ASTM	A 199	Grade T22	K21590	—	60/25 [414/172]	Seamless Tube	2.25Cr-1Mo
5A 1	ASTM	A 200	Grade T21	K31545	—	60/25 [414/172]	Tube	3Cr-1Mo
5A 1	ASTM	A 200	Grade T22	K21590	—	60/25 [414/172]	Tube	2.25Cr-1Mo
5A 1	ASTM	A 200	Grade T4	K31509	—	60/25 [414/172]	Tube	2.5Cr-1Mo-0.75Si
5A 1	ASTM	A 213	Grade T21	K31545	—	60/30 [414/207]	Seamless Tube	3Cr-1Mo
5A 1	ASTM	A 213	Grade T22	K21590	—	60/30 [414/207]	Seamless Tube	2.25Cr-1Mo
5A 1	ASTM	A 217	Grade WC9	J21890	—	70/40 [483/276]	Castings	2.25Cr-1Mo
5A 1	ASTM	A 234	Grade WP22, Class 1	K21590	—	60/30 [414/207]	Pipe Fittings	2.25Cr-1Mo-Mn
5A 1	ASTM	A 234	Grade WP22, Class 3	K21590	—	75/45 [417/310]	Pipe Fittings	2.25Cr-1Mo-Mn
5A 1	ASTM	A 250	Grade T22	K21590	—	60/30 [414/207]	ERW Tube	2.25Cr-1Mo
5A 1	ASTM	A 335	Grade P21	K31545	—	60/30 [414/207]	Seamless Pipe	3Cr-1Mo
5A 1	ASTM	A 335	Grade P22	K21590	—	60/30 [414/207]	Seamless Pipe	2.25Cr-1Mo
5A 1	ASTM	A 336	Grade F21 Class 1	K31545	—	60/30 [414/207]	Forging	3Cr-1Mo
5A 1	ASTM	A 336	Grade F21, Class 3	K31545	—	75/45 [417/310]	Forging	3Cr-1Mo
5A 1	ASTM	A 336	Grade F22, Class 1	K21590	—	60/30 [414/207]	Forging	2.25Cr-1Mo
5A 1	ASTM	A 336	Grade F22, Class 3	K21590	—	75/45 [417/310]	Forging	2.25Cr-1Mo
5A 1	ASTM	A 369	Grade FP21	K31545	—	60/30 [414/207]	Forged Pipe	3Cr-1Mo
5A 1	ASTM	A 369	Grade FP22	K21590	—	60/30 [414/207]	Forged Pipe	2.25Cr-1Mo
5A 1	ASTM	A 387	Grade 21, Class 1	K31545	—	60/30 [414/207]	Plate	3Cr-1Mo
5A 1	ASTM	A 387	Grade 21, Class 2	K31545	—	75/45 [417/310]	Plate	3Cr-1Mo
5A 1	ASTM	A 387	Grade 22, Class 1	K21590	—	60/30 [414/207]	Plate	2.25Cr-1Mo
5A 1	ASTM	A 387	Grade 22, Class 2	K21590	—	75/45 [417/310]	Plate	2.25Cr-1Mo
5A 1	ASTM	A 426	Grade CP21	J31545	—	60/30 [414/207]	Centrifugal Cast Pipe	3Cr-1Mo
5A 1	ASTM	A 426	Grade CP22	J21890	—	70/40 [483/276]	Centrifugal Cast Pipe	2.25Cr-1Mo
5A 1	ASTM	A 691	Grade 3CR, Class 1	K31545	—	60/30 [414/207]	Fusion Welded Pipe	3Cr-1Mo
5A 1	ASTM	A 691	Grade 3CR, Class 2	K31545	—	75/45 [417/310]	Fusion Welded Pipe	3Cr-1Mo
5A 1	ASTM	A 691	Grade 2-1/4CR, Class 1	K21590	—	60/30 [414/207]	Fusion Welded Pipe	2.25Cr-1Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
5A	1	ASTM	A 691	Grade 2-1/4CR, Class 2	K21590	—	Fusion Welded Pipe	2.25Cr-1Mo
5A	1	ASTM	A 739	Grade B22	K21390	—	Bar	2.25Cr-1Mo
5B	1	ASTM	A 182	Grade F5	K41545	—	Pipe Flanges & Fittings	5Cr-0.5Mo
5B	1	ASTM	A 182	Grade F5a	K42544	—	Pipe Flanges & Fittings	5Cr-0.5Mo
5B	1	ASTM	A 182	Grade F9	K90941	—	Pipe Flanges & Fittings	9Cr-1Mo
5B	1	ASTM	A 199	Grade T5	K41545	—	Seamless Tube	5Cr-0.5Mo
5B	1	ASTM	A 199	Grade T9	K81590	—	Seamless Tube	9Cr-1Mo
5B	1	ASTM	A 213	Grade T5b	K51545	—	Seamless Tube	5Cr-0.5Mo-Si
5B	1	ASTM	A 213	Grade T5c	K41245	—	Seamless Tube	5Cr-0.5Mo-Ti
5B	1	ASTM	A 213	Grade T5	K41545	—	Seamless Tube	5Cr-0.5Mo
5B	1	ASTM	A 213	Grade T9	K90941	—	Seamless Tube	9Cr-1Mo
5B	1	ASTM	A 217	Grade C5	J42025	—	Castings	5Cr-0.5Mo
5B	1	ASTM	A 217	Grade C12	J82090	—	Castings	9Cr-1Mo
5B	1	ASTM	A 217	Grade C12A	—	—	Castings	9Cr-1Mo
5B	1	ASTM	A 234	Grade WP5	K41545	—	Pipe Fittings	5Cr-0.5Mo
5B	1	ASTM	A 234	Grade WP9	K90941	—	Pipe Fittings	9Cr-1Mo
5B	1	ASTM	A 335	Grade P5b	K51545	—	Seamless Pipe	5Cr-0.5Mo-Si
5B	1	ASTM	A 335	Grade P5	K41545	—	Seamless Pipe	5Cr-0.5Mo
5B	1	ASTM	A 335	Grade P5c	K41245	—	Seamless Pipe	5Cr-0.5Mo-Ti
5B	1	ASTM	A 335	Grade P9	K81590	—	Seamless Pipe	9Cr-1Mo
5B	1	ASTM	A 336	Grade F5	K41545	—	Forging	5Cr-0.5Mo
5B	1	ASTM	A 336	Grade F5A	K42544	—	Forging	5Cr-0.5Mo
5B	1	ASTM	A 336	Grade F9	K90941	—	Forging	9Cr-1Mo
5B	1	ASTM	A 369	Grade FP9	K90941	—	Forged Pipe	9Cr-1Mo
5B	1	ASTM	A 369	Grade FP5	K41545	—	Forged Pipe	5Cr-0.5Mo
5B	1	ASTM	A 387	Grade 5, Class 1	K41545	—	Plate	5Cr-0.5Mo
5B	1	ASTM	A 387	Grade 5, Class 2	K41545	—	Plate	5Cr-0.5Mo
5B	1	ASTM	A 426	Grade CP5	J42045	—	Centrifugal Cast Pipe	5Cr-0.5Mo
5B	1	ASTM	A 426	Grade CP5b	J51545	—	Centrifugal Cast Pipe	5Cr-1.5Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
5B	1	ASTM	A 426	Grade CP9	—	90/60 [621/414]	Centrifugal Cast Pipe	9Cr-1Mo
5B	1	ASTM	A 691	Grade 5CR, Class 1	—	60/30 [414/207]	Fusion Welded Pipe	5Cr-0.5Mo
5B	1	ASTM	A 691	Grade 5CR, Class 2	—	75/45 [417/310]	Fusion Welded Pipe	5Cr-0.5Mo
5B	2	ASTM	A 182	Grade F91	—	85/60 [586/414]	Pipe Flanges & Fittings	9Cr-1Mo-V
5B	2	ASTM	A 199	Grade T91	—	85/60 [586/414]	Seamless Tube	9Cr-1Mo-V
5B	2	ASTM	A 213	Grade T91	—	85/60 [586/414]	Seamless Tube	9Cr-1Mo-V
5B	2	ASTM	A 234	Grade WP91	—	85/60 [586/414]	Pipe Fittings	9Cr-1Mo-V
5B	2	ASTM	A 335	Grade P91	—	85/60 [586/414]	Seamless Pipe	9Cr-1Mo-V
5B	2	ASTM	A 336	Grade F91	—	85/60 [586/414]	Forging	9Cr-1Mo-V
5B	2	ASTM	A 369	Grade FP91	—	85/60 [586/414]	Forged Pipe	9Cr-1Mo-V
5B	2	ASTM	A 387	Grade 91, Class 2	—	85/60 [586/414]	Plate	9Cr-1Mo-V
5C	1	ASTM	A 182	Grade F3V	—	85/60 [586/414]	Pipe Flanges & Fittings	3Cr-1Mo-0.25V
5C	1	ASTM	A 336	Grade F3V	—	85/60 [586/414]	Forging	3Cr-1Mo-0.25V
5C	1	ASTM	A 487	Grade 8A	—	85/55 [586/379]	Castings	2.25Cr-1Mo
5C	1	ASTM	A 508	Grade 3V	—	85/60 [586/414]	Forging	3Cr-1Mo-0.25V
5C	1	ASTM	A 541	Grade 3V	—	85/60 [586/414]	Forging	3Cr-1Mo-0.25V
5C	1	ASTM	A 541	Grade 22, Class 3	—	85/55 [586/379]	Forging	2.25Cr-1Mo
5C	1	ASTM	A 542	Type B, Class 4a	—	85/60 [586/414]	Plate & Sheet	2.25Cr-1Mo
5C	1	ASTM	A 542	Type A, Class 4	—	85/55 [586/379]	Plate & Sheet	2.25Cr-1Mo
5C	1	ASTM	A 542	Type A, Class 4a	—	85/60 [586/414]	Plate & Sheet	2.25Cr-1Mo
5C	1	ASTM	A 542	Type B, Class 4	—	85/55 [586/379]	Plate & Sheet	2.25Cr-1Mo
5C	1	ASTM	A 542	Type C, Class 4	—	85/55 [586/379]	Plate & Sheet	3Cr-1Mo-0.25V
5C	1	ASTM	A 542	Type C, Class 4a	—	85/60 [586/414]	Plate & Sheet	3Cr-1Mo-0.25V
5C	1	ASTM	A 542	Type D, Class 4a	—	85/60 [586/414]	Plate & Sheet	2.25Cr-1Mo-V
5C	1	ASTM	A 832	Grade 21V	—	85/60 [586/414]	Plate	3Cr-1Mo-0.25V
5C	1	ASTM	A 832	Grade 22V	—	85/60 [586/414]	Pressure Vessel Plate	2.25Cr-1Mo-0.45 Mn-0.3Va-0.13C

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
5C	3	ASTM	A 542	Type A, Class 3	K21590	—	95/75 [655/517]	Plate	2.25Cr-1Mo
5C	3	ASTM	A 542	Type B, Class 3	K21590	—	95/75 [655/517]	Plate	2.25Cr-1Mo
5C	3	ASTM	A 542	Type C, Class 3	K31830	—	95/75 [655/517]	Plate	3Cr-1Mo-V-Ti-B
5C	4	ASTM	A 487	Grade 8, Class B	J22091	—	105/85 [724/586]	Castings	2.25Cr-1Mo
5C	4	ASTM	A 487	Grade 8, Class C	J22091	—	100/75 [689/517]	Castings	2.25Cr-1Mo
5C	4	ASTM	A 541	Grade 22, Class 4	K21390	—	105/85 [724/586]	Forging	2.25Cr-1Mo
5C	4	ASTM	A 542	Type A, Class 1	K21590	—	105/85 [724/586]	Plate	2.25Cr-1Mo
5C	4	ASTM	A 542	Type B, Class 1	K21590	—	105/85 [724/586]	Plate	2.25Cr-1Mo
5C	4	ASTM	A 542	Type C, Class 1	K31830	—	105/85 [724/586]	Plate	3Cr-1Mo-V-Ti-B
5C	5	ASTM	A 541	Grade 22, Class 5	K21390	—	115/100 [793/689]	Forging	2.25Cr-1Mo
5C	5	ASTM	A 542	Type C, Class 2	K31830	—	115/100 [793/689]	Plate	3Cr-1Mo-0.25V
5C	5	ASTM	A 542	Type A, Class 2	K21590	—	115/100 [793/689]	Plate	2.25Cr-1Mo
5C	5	ASTM	A 542	Type B, Class 2	K21590	—	115/100 [793/689]	Plate	2.25Cr-1Mo
6	1	ASTM	A 182	Grade F6a, Class 1	S41000	—	70/40 [483/276]	Pipe Flanges & Fittings	13Cr
6	1	ASTM	A 240	Type 410	S41000	—	65/30 [448/207]	Plate	13Cr
6	1	ASTM	A 268	Type 410	S41000	—	60/30 [414/207]	Tube	13Cr
6	1	ASTM	A 276	Type 410	S41000	—	70/40 [483/276]	Bar	13Cr
6	1	ASTM	A 473	Type 403	S40300	—	70/40 [483/276]	Forging	12Cr
6	1	ASTM	A 473	Type 410	S41000	—	70/40 [483/276]	Forging	13Cr
6	1	ASTM	A 473	Type 414A	S41400	—	65/35 [448/241]	Forging-Annealed	13Cr-2Ni
6	1	ASTM	A 479	Type 403	S40300	—	70/40 [483/276]	Bars & Shapes-Annealed	12Cr
6	1	ASTM	A 479	Type 410	S41000	—	70/40 [483/276]	Bars & Shapes-Annealed	13Cr
6	2	ASTM	A 182	F429	S42900	—	60/35 [414/241]	Pipe Flanges & Fittings	15Cr
6	2	ASTM	A 240	Type 429	S42900	—	65/30 [448/207]	Plate	15Cr

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
6	2	ASTM	A 268	Type 429	S42900	—	60/35 [414/241]	Tube	15Cr
6	2	ASTM	A 473	Type 405	S40500	—	60/30 [414/207]	Forging	13Cr-Al
6	2	ASTM	A 473	Type 420	S42000	—	70/35 [483/241]	Forging	13Cr
6	2	ASTM	A 473	Type 429	S42900	—	65/35 [448/241]	Forging	15Cr
6	2	ASTM	A 473	Type 430	S43000	—	70/35 [483/241]	Forging	17Cr
6	3	ASTM	A 182	Grade F6a, Class 2	S41000	—	85/55 [586/379]	Pipe Flanges & Fittings	13Cr
6	3	ASTM	A 182	Grade F6a, Class 3	S41000	—	110/85 [758/586]	Pipe Flanges & Fittings	13Cr
6	3	ASTM	A 182	Grade F6a, Class 4	S41000	—	130/110 [896/758]	Pipe Flanges & Fittings	13Cr
6	3	ASTM	A 182	Grade F6b	S41026	—	110/90 [758/621]	Pipe Flanges & Fittings	13Cr-0.5Mo
6	3	ASTM	A 217	Grade CA15	J91150	—	90/65 [621/448]	Castings	13Cr
6	3	ASTM	A 336	Grade F6	S41000	—	85/55 [586/379]	Forging	13Cr
6	3	ASTM	A 426	Grade CPCA15	J91150	—	90/65 [621/448]	Cast Pipe	13Cr
6	3	ASTM	A 479	Type 414	S41400	—	115/90 [793/621]	Bars & Shapes	12.5Cr-2Ni-Si
6	3	ASTM	A 487	Grade CA15, Class B	J91450	—	90/65 [621/448]	Castings	13Cr
6	3	ASTM	A 487	Grade CA15, Class C	J91171	—	90/60 [621/414]	Castings	13Cr
6	3	ASTM	A 487	Grade CA15, Class D	J91171	—	100/75 [689/517]	Castings	13Cr
6	3	ASTM	A 487	Grade CA15M, Class A	J91451	—	90/65 [621/448]	Castings	13Cr
6	3	ASTM	A 743	CA-15	J91150	—	90/65 [621/448]	Castings	12.7Cr
6	3	ASTM	A 743	CA-15M	J91151	—	90/65 [621/448]	Castings	12.7Cr-0.58Mo
6	4	ASTM	A 182	Grade F6NM	S41500	—	115/90 [793/621]	Pipe Flanges & Fittings	13Cr-4.5Ni-Mo
6	4	ASTM	A 240	S41500	S41500	—	115/90 [793/621]	Plate	13Cr-4.5Ni-Mo
6	4	ASTM	A 268	S41500	S41500	—	115/90 [793/621]	Seamless & Welded Tube	13Cr-4.5Ni-Mo
6	4	ASTM	A 352	Grade CA6NM	J91540	—	110/80 [758/552]	Castings	13Cr-4Ni
6	4	ASTM	A 479	S41500	S41500	—	115/90 [793/621]	Bars & Shapes	13Cr-4.5Ni-Mo
6	4	ASTM	A 487	Grade CA6NM, Class A	J91540	—	110/80 [758/552]	Castings	13Cr-4Ni
6	4	ASTM	A 487	Grade CA6NM, Class B	J91540	—	100/75 [689/517]	Castings	13Cr-4Ni
6	4	ASTM	A 731	S41500	S41500	—	115/90 [793/621]	Seamless & Welded Pipe	13Cr-4.5Ni-Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
6	4	ASTM	A 743	CA-40	J91153	100/70 [689/483]	Castings	12.75Cr
6	4	ASTM	A 743	CB-6	J91804	115/85 [793/586]	Castings	16.5Cr-4.5Ni
6	4	ASTM	A 743	CA-6NM	J91540	110/80 [758/552]	Castings	12.7Cr-4Ni-0.7Mo
6	4	ASTM	A 815	S41500	S41500	110/90 [758/621]	Pipe Fittings	13Cr-4.5Ni-Mo
7	1	ASTM	A 240	Type 405	S40500	60/25 [414/172]	Plate	12Cr-1Al
7	1	ASTM	A 240	Type 409	S40900	55/25 [379/172]	Plate	11Cr-Ti
7	1	ASTM	A 240	Type 410S	S41008	60/30 [414/207]	Plate	13Cr
7	1	ASTM	A 268	S40800	S40800	55/30 [379/207]	Seamless & Welded Tube	12Cr-Ti
7	1	ASTM	A 268	Type 405	S40500	60/30 [414/207]	Tube	12Cr-1Al
7	1	ASTM	A 268	Type 409	S40900	55/30 [379/207]	Plate	11Cr-Ti
7	1	ASTM	A 268	Type 430 Ti	S43036	60/35 [414/241]	Seamless & Welded Tube	18Cr-Ti-Cb
7	1	ASTM	A 479	Type 405	S40500	60/25 [414/172]	Bars & Shapes	12Cr-1Al
7	2	ASTM	A 182	F430	S43000	60/35 [414/241]	Pipe Flanges & Fittings	17Cr
7	2	ASTM	A 240	Type 18-2	S44400	60/40 [414/276]	Plate	18Cr-2Mo
7	2	ASTM	A 240	Type 430	S43000	65/30 [448/207]	Plate	17Cr
7	2	ASTM	A 240	Type 439	S43035	65/30 [448/207]	Plate, Sheet & Strip	17Cr-Ti
7	2	ASTM	A 240	Type XM-27	S44627	65/40 [448/276]	Plate	27Cr-1Mo
7	2	ASTM	A 268	Type 18Cr-2Mo	S44400	60/40 [414/276]	Seamless & Welded Tube	18Cr-2Mo
7	2	ASTM	A 268	Type 430	S43000	60/35 [414/241]	Tube	17Cr
7	2	ASTM	A 268	Type 439	S43035	60/30 [414/207]	Seamless & Welded Tube	17Cr-Ti
7	2	ASTM	A 479	S44400	S44400	60/45 [414/310]	Bars & Shapes	18Cr-2Mo
7	2	ASTM	A 479	Type 430	S43000	70/40 [483/276]	Bars & Shapes	17Cr
7	2	ASTM	A 479	Type 439	S43035	70/40 [483/276]	Bars & Shapes	17Cr-Ti
7	2	ASTM	A 731	Type 439	S43035	60/30 [414/207]	Seamless & Welded Pipe	17Cr-Ti
7	2	ASTM	A 731	Type 18Cr-2Mo	S44400	60/40 [414/276]	Seamless & Welded Pipe	18Cr-2Mo
7	2	ASTM	A 803	Type 439	S43035	60/30 [414/207]	Welded Tube	17Cr-Ti

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form		Nominal Composition
Steel and Steel Alloys									
7	3	ASTM	A 479	Type XM-30	S41040	—	70/40 [483/276]	Bars & Shapes	12.5Cr-Cb
8	1	ASTM	A 182	Grade F304	S30400	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	18Cr-8Ni
8	1	ASTM	A 182	Grade F304	S30400	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	18Cr-8Ni
8	1	ASTM	A 182	Grade F304H	S30409	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	18Cr-8Ni
8	1	ASTM	A 182	Grade F304H	S30409	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	18Cr-8Ni
8	1	ASTM	A 182	Grade F304L	S30403	≤5.0 [125]	70/25 [483/172]	Pipe Flanges & Fittings	18Cr-8Ni
8	1	ASTM	A 182	Grade F304L	S30403	>5.0 [125]	65/25 [448/172]	Pipe Flanges & Fittings	18Cr-8Ni
8	1	ASTM	A 182	Grade F304LN	S30453	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	18Cr-8Ni-N
8	1	ASTM	A 182	Grade F304LN	S30453	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	18Cr-8Ni-N
8	1	ASTM	A 182	Grade F304N	S30451	—	80/35 [552/241]	Pipe Flanges & Fittings	18Cr-8Ni-N
8	1	ASTM	A 182	Grade F316	S31600	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	16Cr-12Ni-2Mo
8	1	ASTM	A 182	Grade F316	S31600	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	16Cr-12Ni-2Mo
8	1	ASTM	A 182	Grade F316H	S31609	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	16Cr-12Ni-2Mo
8	1	ASTM	A 182	Grade F316H	S31609	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	16Cr-12Ni-2Mo
8	1	ASTM	A 182	Grade F316L	S31603	≤5.0 [125]	70/25 [483/172]	Pipe Flanges & Fittings	16Cr-12Ni-2Mo
8	1	ASTM	A 182	Grade F316L	S31603	>5.0 [125]	65/25 [448/172]	Pipe Flanges & Fittings	16Cr-12Ni-2Mo
8	1	ASTM	A 182	Grade F316LN	S31653	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	16Cr-12Ni-2Mo-N
8	1	ASTM	A 182	Grade F316LN	S31653	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	16Cr-12Ni-2Mo-N
8	1	ASTM	A 182	Grade F316N	S31651	—	80/35 [552/241]	Pipe Flanges & Fittings	16Cr-12Ni-2Mo-N
8	1	ASTM	A 182	Grade F317	S31700	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	18Cr-13Ni-3Mo
8	1	ASTM	A 182	Grade F317	S31700	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	18Cr-13Ni-3Mo
8	1	ASTM	A 182	Grade F317L	S31703	≤5.0 [125]	70/25 [483/172]	Pipe Flanges & Fittings	18Cr-13Ni-3Mo
8	1	ASTM	A 182	Grade F317L	S31703	>5.0 [125]	65/25 [448/172]	Pipe Flanges & Fittings	18Cr-13Ni-3Mo
8	1	ASTM	A 182	Grade F321	S32100	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	18Cr-10Ni-Ti
8	1	ASTM	A 182	Grade F321	S32100	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	18Cr-10Ni-Ti
8	1	ASTM	A 182	Grade F321H	S32109	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	18Cr-10Ni-Ti
8	1	ASTM	A 182	Grade F321H	S32109	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	18Cr-10Ni-Ti
8	1	ASTM	A 182	Grade F347	S34700	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	18Cr-10Ni-Cb

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Steel and Steel Alloys		Nominal Composition
							Product Form		
8	1	ASTM	A 182	Grade F347	S34700	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 182	Grade F347H	S34709	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 182	Grade F347H	S34709	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 182	Grade F348	S34800	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 182	Grade F348	S34800	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 182	Grade F348H	S34809	≤5.0 [125]	75/30 [517/207]	Pipe Flanges & Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 182	Grade F348H	S34809	>5.0 [125]	70/30 [483/207]	Pipe Flanges & Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 182	Grade F46	S30600	—	78/35 [538/241]	Pipe Flanges & Fittings	18Cr-15Ni-4Si
8	1	ASTM	A 213	Grade XM-15	S38100	—	75/30 [517/207]	Seamless Tube	18Cr-18Ni-2Si
8	1	ASTM	A 213	TP304	S30400	—	75/30 [517/207]	Seamless Tube	18Cr-8Ni
8	1	ASTM	A 213	TP304H	S30409	—	75/30 [517/207]	Seamless Tube	18Cr-8Ni
8	1	ASTM	A 213	TP304L	S30403	—	70/25 [483/172]	Seamless Tube	18Cr-8Ni
8	1	ASTM	A 213	TP304LN	S30453	—	75/30 [517/207]	Seamless Tube	18Cr-8Ni-N
8	1	ASTM	A 213	TP304N	S30451	—	80/35 [552/241]	Seamless Tube	18Cr-8Ni-N
8	1	ASTM	A 213	TP316	S31600	—	75/30 [517/207]	Seamless Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 213	TP316H	S31609	—	75/30 [517/207]	Seamless Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 213	TP316L	S31603	—	70/25 [483/172]	Seamless Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 213	TP316LN	S31653	—	75/30 [517/207]	Seamless Tube	16Cr-12Ni-2Mo-N
8	1	ASTM	A 213	TP316N	S31651	—	80/35 [552/241]	Seamless Tube	16Cr-12Ni-2Mo-N
8	1	ASTM	A 213	TP321	S32100	—	75/30 [517/207]	Seamless Tube	18Cr-10Ni-Ti
8	1	ASTM	A 213	TP321H	S32109	—	75/30 [517/207]	Seamless Tube	18Cr-10Ni-Ti
8	1	ASTM	A 213	TP347	S34700	—	75/30 [517/207]	Seamless Tube	18Cr-10Ni-Cb
8	1	ASTM	A 213	TP347H	S34709	—	75/30 [517/207]	Seamless Tube	18Cr-10Ni-Cb
8	1	ASTM	A 213	TP348	S34800	—	75/30 [517/207]	Seamless Tube	18Cr-10Ni-Cb
8	1	ASTM	A 213	TP348H	S34809	—	75/30 [517/207]	Seamless Tube	18Cr-10Ni-Cb
8	1	ASTM	A 240	Type 18-15	S30600	—	78/35 [538/241]	Plate, Sheet & Strip	18Cr-15Ni-4Si
8	1	ASTM	A 240	Type 316L	S31603	—	70/25 [483/172]	Plate, Sheet & Strip	16Cr-12Ni-2Mo
8	1	ASTM	A 240	Type 302	S30200	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-8Ni
8	1	ASTM	A 240	Type 304	S30400	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-8Ni

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
8	1	ASTM	A 240	Type 304H	S30409	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-8Ni
8	1	ASTM	A 240	Type 304L	S30403	—	70/25 [483/172]	Plate, Sheet & Strip	18Cr-8Ni
8	1	ASTM	A 240	Type 304LN	S30453	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-8Ni-N
8	1	ASTM	A 240	Type 304N	S30451	—	80/35 [552/241]	Plate, Sheet & Strip	18Cr-8Ni-N
8	1	ASTM	A 240	Type 305	S30500	—	78/30 [538/207]	Plate, Sheet & Strip	18Cr-15Ni-4Si
8	1	ASTM	A 240	Type 316	S31600	—	75/30 [517/207]	Plate, Sheet & Strip	16Cr-12Ni-1Mo
8	1	ASTM	A 240	Type 316Cb	S31640	—	75/30 [517/207]	Plate, Sheet & Strip	16Cr-12Ni-2Mo-Cb
8	1	ASTM	A 240	Type 316H	S31609	—	80/35 [552/241]	Plate, Sheet & Strip	16Cr-12N-2Mo
8	1	ASTM	A 240	Type 316LN	S31653	—	75/30 [517/207]	Plate, Sheet & Strip	16Cr-12Ni-2Mo-N
8	1	ASTM	A 240	Type 316N	S31651	—	80/35 [552/241]	Plate, Sheet & Strip	16Cr-12Ni-2Mo-N
8	1	ASTM	A 240	Type 316Ti	S31635	—	75/30 [517/207]	Plate, Sheet & Strip	16Cr-12Ni-2Mo-Ti
8	1	ASTM	A 240	Type 317	S31700	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-13Ni-3Mo
8	1	ASTM	A 240	Type 317L	S31703	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-13Ni-3Mo
8	1	ASTM	A 240	Type 317LN	S31753	—	80/35 [552/241]	Plate, Sheet & Strip	18Cr-13Ni-3Mo-N
8	1	ASTM	A 240	Type 321	S32100	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-10Ni-Ti
8	1	ASTM	A 240	Type 321H	S32109	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-10Ni-Ti
8	1	ASTM	A 240	Type 347	S34700	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-10Ni-Cb
8	1	ASTM	A 240	Type 347H	S34709	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-10Ni-Cb
8	1	ASTM	A 240	Type 348	S34800	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-10Ni-Cb
8	1	ASTM	A 240	Type 348H	S34809	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-10Ni-Cb
8	1	ASTM	A 240	Type XM-15	S38100	—	75/30 [517/207]	Plate, Sheet & Strip	18Cr-18Ni-2Si
8	1	ASTM	A 240	Type XM-21	S30452	≤0.1875 [5]	90/50 [621/345]	Sheet & Strip	18Cr-8Ni-N
8	1	ASTM	A 240	Type XM-21	S30452	>0.1875 [5]	85/40 [586/276]	Plate	18Cr-8Ni-N
8	1	ASTM	A 249	TP316LN	S31653	—	75/30 [517/207]	Welded Tube	16Cr-12Ni-2Mo-N
8	1	ASTM	A 249	TP316N	S31651	—	80/35 [552/241]	Welded Tube	16Cr-12Ni-2Mo-N
8	1	ASTM	A 249	TP317	S31700	—	75/30 [517/207]	Welded Tube	18Cr-13Ni-3Mo
8	1	ASTM	A 249	TP317L	S31703	—	75/30 [517/207]	Welded Tube	18Cr-13Ni-3Mo
8	1	ASTM	A 249	TP321	S32100	—	75/30 [517/207]	Welded Tube	18Cr-10Ni-Ti
8	1	ASTM	A 249	TP321H	S32109	—	75/30 [517/207]	Welded Tube	18Cr-10Ni-Ti

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
8	1	ASTM	A 249	TP347	—	75/30 [517/207]	Welded Tube	18Cr-10Ni-Cb
8	1	ASTM	A 249	TP347H	—	75/30 [517/207]	Welded Tube	18Cr-10Ni-Cb
8	1	ASTM	A 249	TP348	—	75/30 [517/207]	Welded Tube	18Cr-10Ni-Cb
8	1	ASTM	A 249	TP348H	—	75/30 [517/207]	Welded Tube	18Cr-10Ni-Cb
8	1	ASTM	A 249	Type 304	—	75/30 [517/207]	Welded Tube	18Cr-8Ni
8	1	ASTM	A 249	Type 304H	—	75/30 [517/207]	Welded Tube	18Cr-8Ni
8	1	ASTM	A 249	Type 304L	—	70/25 [483/172]	Welded Tube	18Cr-8Ni
8	1	ASTM	A 249	Type 304LN	—	75/30 [517/207]	Welded Tube	18Cr-8Ni-N
8	1	ASTM	A 249	Type 304N	—	80/35 [552/241]	Welded Tube	18Cr-8Ni-N
8	1	ASTM	A 249	Type 316	—	75/30 [517/207]	Welded Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 249	Type 316H	—	75/30 [517/207]	Welded Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 249	Type 316L	—	70/25 [483/172]	Welded Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 249	Type XM-15	—	75/30 [517/207]	Welded Tube	18Cr-18Ni-2Si
8	1	ASTM	A 269	TP304	—	75/30 [517/207]	Seamless & Welded Pipe	18Cr-8Ni
8	1	ASTM	A 269	TP304L	—	70/25 [483/172]	Seamless & Welded Pipe	18Cr-8Ni
8	1	ASTM	A 269	TP316	—	75/30 [517/207]	Seamless & Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 269	TP316L	—	70/25 [483/172]	Seamless & Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 269	Type 304LN	—	75/30 [517/207]	Seamless & Welded Pipe	18Cr-8Ni-N
8	1	ASTM	A 269	Type 316LN	—	75/30 [517/207]	Seamless & Welded Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	A 269	Type 317	—	75/30 [517/207]	Seamless & Welded Pipe	18Cr-13Ni-3Mo
8	1	ASTM	A 269	Type 321	—	75/30 [517/207]	Seamless & Welded Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 269	Type 347	—	75/30 [517/207]	Seamless & Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 269	Type 348	—	75/30 [517/207]	Seamless & Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 270	Type 304	—	75/30 [517/207]	Seamless & Welded Pipe	18Cr-8Ni
8	1	ASTM	A 271	Type 304	—	75/30 [517/207]	Seamless & Welded Pipe	18Cr-8Ni
8	1	ASTM	A 271	Type 304H	—	75/30 [517/207]	Seamless Tube	18Cr-8Ni
8	1	ASTM	A 271	Type 316	—	75/30 [517/207]	Seamless Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 271	Type 316H	—	75/30 [517/207]	Seamless Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 271	Type 321	—	75/30 [517/207]	Seamless Tube	18Cr-10Ni-Ti

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
8	1	ASTM	A 271	Type 321H	S32109	—	Seamless Tube	18Cr-10Ni-Ti
8	1	ASTM	A 271	Type 347	S34700	—	Seamless Tube	18Cr-10Ni-Cb
8	1	ASTM	A 271	Type 347H	S34709	—	Seamless Tube	18Cr-10Ni-Cb
8	1	ASTM	A 276	Type 304	S30400	—	Bar	18Cr-8Ni
8	1	ASTM	A 276	Type 304L	S30403	—	Bar	18Cr-8Ni
8	1	ASTM	A 276	Type 316	S31600	—	Bar	16Cr-12Ni-2Mo
8	1	ASTM	A 276	Type 316L	S31603	—	Bar	16Cr-12Ni-2Mo
8	1	ASTM	A 312	TP304	S30400	—	Seamless & Welded Pipe	18Cr-8Ni
8	1	ASTM	A 312	TP304H	S30409	—	Seamless & Welded Pipe	18Cr-8Ni
8	1	ASTM	A 312	TP304L	S30403	—	Seamless & Welded Pipe	18Cr-8Ni
8	1	ASTM	A 312	TP304LN	S30453	—	Seamless & Welded Pipe	18Cr-8Ni-N
8	1	ASTM	A 312	TP304N	S30451	—	Seamless & Welded Pipe	18Cr-8Ni-N
8	1	ASTM	A 312	TP316	S31600	—	Seamless & Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 312	TP316H	S31609	—	Seamless & Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 312	TP316L	S31603	—	Seamless & Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 312	TP316LN	S31653	—	Seamless & Welded Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	A 312	TP316N	S31651	—	Seamless & Welded Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	A 312	TP317	S31700	—	Seamless & Welded Pipe	18Cr-13Ni-3Mo
8	1	ASTM	A 312	TP317L	S31703	—	Seamless & Welded Pipe	18Cr-13Ni-3Mo
8	1	ASTM	A 312	TP321	S32100	≤3/8 [10]	Seamless Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 312	TP321	S32100	>3/8 [10]	Seamless Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 312	TP321	S32100	—	Welded Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 312	TP321H	S32109	≤3/8 [10]	Seamless Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 312	TP321H	S32109	>3/8 [10]	Seamless Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 312	TP321H	S32109	—	Welded Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 312	TP347	S34700	—	Seamless & Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 312	TP347H	S34709	—	Seamless & Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 312	TP348	S34800	—	Seamless & Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 312	TP348H	S34809	—	Seamless & Welded Pipe	18Cr-10Ni-Cb

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]		Product Form	Nominal Composition
Steel and Steel Alloys									
8	1	ASTM	A 312	TPXM-15	—	75/30	[517/207]	Seamless & Welded Pipe	18Cr-18Ni-2Si
8	1	ASTM	A 336	F304	—	70/30	[483/207]	Forging	18Cr-8Ni
8	1	ASTM	A 336	F304H	—	70/30	[483/207]	Forging	18Cr-8Ni
8	1	ASTM	A 336	F304L	—	65/25	[448/172]	Forging	18Cr-8Ni
8	1	ASTM	A 336	F304LN	—	70/30	[483/207]	Forging	18Cr-8Ni-N
8	1	ASTM	A 336	F304N	—	80/35	[552/241]	Forging	18Cr-8Ni-N
8	1	ASTM	A 336	F316	—	70/30	[483/207]	Forging	16Cr-12Ni-2Mo
8	1	ASTM	A 336	F316H	—	70/30	[483/207]	Forging	16Cr-12Ni-2Mo
8	1	ASTM	A 336	F316L	—	65/25	[448/172]	Forging	16Cr-12Ni-2Mo
8	1	ASTM	A 336	F316LN	—	70/30	[483/207]	Forging	16Cr-12Ni-2Mo-N
8	1	ASTM	A 336	F316N	—	80/35	[552/241]	Forging	16Cr-12Ni-2Mo-N
8	1	ASTM	A 336	F321	—	70/x30	[483/207]	Forging	18Cr-10Ni-Ti
8	1	ASTM	A 336	F321H	—	70/30	[483/207]	Forging	18Cr-10Ni-Ti
8	1	ASTM	A 336	F347	—	70/30	[483/207]	Forging	18Cr-10Ni-Cb
8	1	ASTM	A 336	F347H	—	70/30	[483/207]	Forging	18Cr-10Ni-Cb
8	1	ASTM	A 336	F348	—	70/30	[483/207]	Forging	18Cr-10Ni-Cb
8	1	ASTM	A 336	F348H	—	65/25	[448/172]	Forging	18Cr-10Ni-Cb
8	1	ASTM	A 351	CF10	—	70/30	[483/207]	Castings	19Cr-9Ni-5Mo
8	1	ASTM	A 351	CF10M	—	70/30	[483/207]	Castings	19Cr-9Ni-5Mo
8	1	ASTM	A 351	CF10MC	—	70/30	[483/207]	Castings	16Cr-14Ni-2Mo
8	1	ASTM	A 351	CF3	—	70/30	[483/207]	Castings	18Cr-8Ni
8	1	ASTM	A 351	CF3A	—	77/35	[531/241]	Castings	18Cr-8Ni
8	1	ASTM	A 351	CF3M	—	70/30	[483/207]	Castings	18Cr-12Ni-2Mo
8	1	ASTM	A 351	CF8	—	70/30	[483/207]	Castings	18Cr-8Ni
8	1	ASTM	A 351	CF8A	—	77/35	[531/241]	Castings	18Cr-8Ni
8	1	ASTM	A 351	CF8C	—	70/30	[483/207]	Castings	18Cr-10Ni-Cb
8	1	ASTM	A 351	CF8M	—	70/30	[483/207]	Castings	18Cr-12Ni-2Mo
8	1	ASTM	A 351	CG8M	—	75/35	[517/241]	Castings	19Cr-10Ni-3Mo
8	1	ASTM	A 358	304	—	75/30	[517/207]	Welded Pipe	18Cr-8Ni

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
8	1	ASTM	A 358	304H	—	75/30 [517/207]	Welded Pipe	18Cr-8Ni
8	1	ASTM	A 358	304L	—	70/25 [483/172]	Welded Pipe	18Cr-8Ni
8	1	ASTM	A 358	304LN	—	75/30 [517/207]	Welded Pipe	18Cr-8Ni-N
8	1	ASTM	A 358	304N	—	80/35 [552/241]	Welded Pipe	18Cr-8Ni-N
8	1	ASTM	A 358	316	—	75/30 [517/207]	Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 358	316H	—	75/30 [517/207]	Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 358	316L	—	70/25 [483/172]	Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 358	316LN	—	75/35 [517/241]	Welded Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	A 358	316N	—	80/35 [552/241]	Welded Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	A 358	321	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 358	347	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 358	348	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 376	16-8-2H	—	75/30 [517/207]	Seamless Pipe	16Cr-8Ni-2Mo
8	1	ASTM	A 376	TP304	≤Schedule 140	75/30 [517/207]	Seamless Pipe	18Cr-8Ni
8	1	ASTM	A 376	TP304	>Schedule 140	70/30 [483/207]	Seamless Pipe	18Cr-8Ni
8	1	ASTM	A 376	TP304H	—	75/30 [517/207]	Seamless Pipe	18Cr-8Ni
8	1	ASTM	A 376	TP304LN	—	75/30 [517/207]	Seamless Pipe	18Cr-8Ni-N
8	1	ASTM	A 376	TP304N	—	80/35 [552/241]	Seamless Pipe	18Cr-8Ni-N
8	1	ASTM	A 376	TP316	—	75/30 [517/207]	Seamless Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 376	TP316H	—	75/30 [517/207]	Seamless Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 376	TP316LN	—	75/30 [517/207]	Seamless Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	A 376	TP316N	—	80/35 [552/241]	Seamless Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	A 376	TP321	≤3/8 [10]	75/30 [517/207]	Seamless Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 376	TP321	>3/8 [10]	70/25 [483/172]	Seamless Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 376	TP321H	≤3/8 [10]	75/30 [517/207]	Seamless Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 376	TP321H	>3/8 [10]	70/25 [483/172]	Seamless Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 376	TP347	—	75/30 [517/207]	Seamless Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 376	TP347H	—	75/30 [517/207]	Seamless Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 376	TP348	—	75/30 [517/207]	Seamless Pipe	18Cr-10Ni-Cb

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum		Product Form	Nominal Composition
						Tensile/Yield Strength, ksi [MPa]			
Steel and Steel Alloys									
8	1	ASTM	A 403	WP304	S30400	—	75/30 [517/207]	Pipe Fittings	18Cr-8Ni
8	1	ASTM	A 403	WP304H	S30409	—	75/30 [517/207]	Pipe Fittings	18Cr-8Ni
8	1	ASTM	A 403	WP304L	S30403	—	70/25 [483/172]	Pipe Fittings	18Cr-8Ni
8	1	ASTM	A 403	WP304LN	S30453	—	75/30 [517/207]	Pipe Fittings	18Cr-8Ni-N
8	1	ASTM	A 403	WP304N	S30451	—	80/35 [552/241]	Pipe Fittings	18Cr-8Ni-N
8	1	ASTM	A 403	WP316	S31600	—	75/30 [517/207]	Pipe Fittings	16Cr-12Ni-2Mo
8	1	ASTM	A 403	WP316H	S31609	—	75/30 [517/207]	Pipe Fittings	16Cr-12Ni-2Mo
8	1	ASTM	A 403	WP316L	S31603	—	70/25 [483/172]	Pipe Fittings	16Cr-12Ni-2Mo
8	1	ASTM	A 403	WP316LN	S31653	—	75/30 [517/207]	Pipe Fittings	16Cr-12Ni-2Mo-N
8	1	ASTM	A 403	WP316N	S31651	—	80/35 [552/241]	Pipe Fittings	16Cr-12Ni-2Mo-N
8	1	ASTM	A 403	WP317	S31700	—	75/30 [517/207]	Pipe Fittings	18Cr-13Ni-3Mo
8	1	ASTM	A 403	WP317L	S31703	—	75/30 [517/207]	Pipe Fittings	18Cr-13Ni-3Mo
8	1	ASTM	A 403	WP321	S32100	—	75/30 [517/207]	Pipe Fittings	18Cr-10Ni-Ti
8	1	ASTM	A 403	WP321H	S32109	—	75/30 [517/207]	Pipe Fittings	18Cr-10Ni-Ti
8	1	ASTM	A 403	WP347	S34700	—	75/30 [517/207]	Pipe Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 403	WP347H	S34709	—	75/30 [517/207]	Pipe Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 403	WP348	S34800	—	75/30 [517/207]	Pipe Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 403	WP348H	S34809	—	75/30 [517/207]	Pipe Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 409	TP304	S30400	—	75/30 [517/207]	Welded Pipe	18Cr-8Ni
8	1	ASTM	A 409	TP304L	S30403	—	70/25 [483/172]	Welded Pipe	18Cr-8Ni
8	1	ASTM	A 409	TP316	S31600	—	75/30 [517/207]	Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 409	TP316L	S31603	—	70/25 [483/172]	Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	A 409	TP317	S31700	—	75/30 [517/207]	Welded Pipe	18Cr-13Ni-3Mo
8	1	ASTM	A 409	TP321	S32100	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Ti
8	1	ASTM	A 409	TP347	S34700	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 409	TP348	S34800	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	A 430	FP16-8-2H	S16800	—	70/30 [483/207]	Forged Pipe	16Cr-8Ni-2Mo
8	1	ASTM	A 430	FP304	S30400	—	70/30 [483/207]	Forged Pipe	18Cr-8Ni
8	1	ASTM	A 430	FP304H	S30409	—	70/30 [483/207]	Forged Pipe	18Cr-8Ni

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum		Product Form	Nominal Composition
						Tensile/Yield Strength,	ksi [MPa]		
Steel and Steel Alloys									
8	1	ASTM	FP304N	S30451	—	75/35	[517/241]	Forged Pipe	18Cr-8Ni-N
8	1	ASTM	FP316	S31600	—	70/30	[483/207]	Forged Pipe	16Cr-12Ni-2Mo
8	1	ASTM	FP316H	S31609	—	70/30	[483/207]	Forged Pipe	16Cr-12Ni-2Mo
8	1	ASTM	FP316N	S31651	—	75/35	[517/241]	Forged Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	FP321	S32100	—	70/30	[483/207]	Forged Pipe	18Cr-10Ni-Ti
8	1	ASTM	FP321H	S32109	—	70/30	[483/207]	Forged Pipe	18Cr-10Ni-Ti
8	1	ASTM	FP347	S34700	—	70/30	[483/207]	Forged Pipe	18Cr-10Ni-Cb
8	1	ASTM	FP347H	S34709	—	70/30	[483/207]	Forged Pipe	18Cr-10Ni-Cb
8	1	ASTM	CPF10MC	J92971	—	70/30	[483/207]	Centrifugal Cast Pipe	16Cr-14Ni-2Mo
8	1	ASTM	CPF3	J92500	—	70/30	[483/207]	Centrifugal Cast Pipe	18Cr-8Ni
8	1	ASTM	CPF3A	J92500	—	77/35	[531/241]	Centrifugal Cast Pipe	18Cr-8Ni
8	1	ASTM	CPF3M	J92800	—	70/30	[483/207]	Centrifugal Cast Pipe	16Cr-12Ni-2Mo
8	1	ASTM	CPF8	J92600	—	70/30	[483/207]	Centrifugal Cast Pipe	18Cr-8Ni
8	1	ASTM	CPF8A	J92600	—	77/35	[531/241]	Centrifugal Cast Pipe	18Cr-8Ni
8	1	ASTM	CPF8C	J92710	—	70/30	[483/207]	Centrifugal Cast Pipe	18Cr-10Ni-Cb
8	1	ASTM	CPF8M	J92900	—	70/30	[483/207]	Centrifugal Cast Pipe	18Cr-12Ni-2Mo
8	1	ASTM	TP304H	S30409	—	75/30	[517/207]	Centrifugal Cast Pipe	18Cr-8Ni
8	1	ASTM	TP316H	S31609	—	75/30	[517/207]	Centrifugal Cast Pipe	16Cr-12Ni-2Mo
8	1	ASTM	TP347H	S34709	—	75/90	[517/621]	Centrifugal Cast Pipe	18Cr-10Ni-Cb
8	1	ASTM	Type 302	S30200	—	75/30	[517/207]	Forging	18Cr-5Ni-9Mn
8	1	ASTM	Type 302B	S30215	—	75/30	[517/207]	Forging	18Cr-8Ni-Si
8	1	ASTM	Type 303	S30300	—	75/30	[517/207]	Forging	18Cr-8Ni-S
8	1	ASTM	Type 303Se	S30323	—	75/30	[517/207]	Forging	18Cr-8Ni-Se
8	1	ASTM	Type 304	S30400	≤5 [125]	75/30	[517/207]	Forging	18Cr-8Ni
8	1	ASTM	Type 304	S30400	>5 [125]	70/30	[483/207]	Forging	18Cr-8Ni
8	1	ASTM	Type 304L	S30403	—	65/25	[448/172]	Forging	18Cr-8Ni
8	1	ASTM	Type 305	S30500	—	75/30	[517/207]	Forging	18Cr-12Ni
8	1	ASTM	Type 316	S31600	≤5 [125]	75/30	[517/207]	Forging	16Cr-12Ni-2Mo
8	1	ASTM	Type 316	S31600	>5 [125]	70/30	[483/207]	Forging	16Cr-12Ni-2Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
8	1	ASTM	A 473	Type 316L	S31603	65/25 [448/172]	Forging	16Cr-12Ni-2Mo
8	1	ASTM	A 473	Type 317	S31700	75/30 [517/207]	Forging	18Cr-13Ni-3Mo
8	1	ASTM	A 473	Type 321	S32100	75/30 [517/207]	Forging	18Cr-10Ni-Ti
8	1	ASTM	A 473	Type 347	S34700	75/30 [517/207]	Forging	18Cr-10Ni-Cb
8	1	ASTM	A 473	Type 348	S34800	75/30 [517/207]	Forging	18Cr-10Ni-Cb
8	1	ASTM	A 479	304H	S30409	75/30 [517/207]	Bar	18Cr-8Ni
8	1	ASTM	A 479	304H	S30409	70/30 [483/207]	Shapes	18Cr-8Ni
8	1	ASTM	A 479	304L	S30403	70/25 [483/172]	Bars & Shapes	18Cr-8Ni
8	1	ASTM	A 479	304LN	S30453	75/30 [517/207]	Bars & Shapes	18Cr-8Ni-N
8	1	ASTM	A 479	304N	S30451	80/35 [552/241]	Bars & Shapes	18Cr-8Ni-N
8	1	ASTM	A 479	316Cb	S31640	75/30 [517/207]	Bars & Shapes	16Cr-12Ni-2Mo-Cb
8	1	ASTM	A 479	316H	S31609	75/30 [517/207]	Bars & Shapes	16Cr-12Ni-2Mo
8	1	ASTM	A 479	316L	S31603	70/25 [483/172]	Bars & Shapes	16Cr-12Ni-2Mo
8	1	ASTM	A 479	316LN	S31653	75/30 [517/207]	Bars & Shapes	16Cr-12Ni-2Mo-N
8	1	ASTM	A 479	316N	S31651	80/35 [552/241]	Bars & Shapes	16Cr-12Ni-2Mo-N
8	1	ASTM	A 479	316Ti	S31635	75/30 [517/207]	Bars & Shapes	16Cr-12Ni-2Mo-Ti
8	1	ASTM	A 479	321H	S32109	75/30 [517/207]	Bars & Shapes	18Cr-10Ni-Ti
8	1	ASTM	A 479	347H	S34709	75/30 [517/207]	Bars & Shapes	18Cr-10Ni-Cb
8	1	ASTM	A 479	348H	S34809	75/30 [517/207]	Bars & Shapes	18Cr-10Ni-Cb
8	1	ASTM	A 479	Type 306	S30600	78/35 [538/241]	Bars & Shapes	17Cr-14Ni-4Si
8	1	ASTM	A 479	Type 302	S30200	75/30 [517/207]	Bars & Shapes	18Cr-8Ni
8	1	ASTM	A 479	Type 304	S30400	75/30 [517/207]	Bars & Shapes	18Cr-8Ni
8	1	ASTM	A 479	Type 316	S31600	75/30 [517/207]	Bars & Shapes	16Cr-12Ni-2Mo
8	1	ASTM	A 479	Type 321	S32100	75/30 [517/207]	Bars & Shapes	18Cr-10Ni-Ti
8	1	ASTM	A 479	Type 347	S34700	75/30 [517/207]	Bars & Shapes	18Cr-10Ni-Cb
8	1	ASTM	A 479	Type 348	S34800	75/30 [517/207]	Bars & Shapes	18Cr-10Ni-Cb
8	1	ASTM	A 511	MT 302	S30200	75/30 [515/210]	Welded Tube	18Cr-8Ni
8	1	ASTM	A 511	MT 304	S30400	75/30 [515/210]	Welded Tube	18Cr-8Ni
8	1	ASTM	A 511	MT 304L	S30403	75/30 [515/210]	Welded Tube	18Cr-8Ni

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
8	1	ASTM	A 511	MT 316	S31600	—	Welded Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 511	MT 316L	S31603	—	Welded Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 511	MT 317	S31700	—	Welded Tube	18Cr-13Ni-3Mo
8	1	ASTM	A 511	MT 321	S32100	—	Welded Tube	18Cr-10Ni-Ti
8	1	ASTM	A 511	MT 347	S34700	—	Welded Tube	18Cr-10Ni-Cb
8	1	ASTM	A 554	MT 302	S30200	—	Welded Tube	18Cr-8Ni
8	1	ASTM	A 554	MT 304	S30400	—	Welded Tube	18Cr-8Ni
8	1	ASTM	A 554	MT 304L	S30403	—	Welded Tube	18Cr-8Ni
8	1	ASTM	A 554	MT 316	S31600	—	Welded Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 554	MT 316L	S31603	—	Welded Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 554	MT 317	S31700	—	Welded Tube	18Cr-13Ni-3Mo
8	1	ASTM	A 554	MT 321	S32100	—	Welded Tube	18Cr-10Ni-Ti
8	1	ASTM	A 554	MT 347	S34700	—	Welded Tube	18Cr-10Ni-Cb
8	1	ASTM	A 666	Type 302	S30200	—	Plate, Sheet & Strip	18Cr-8Ni
8	1	ASTM	A 666	Type 304	S30400	—	Plate, Sheet & Strip	18Cr-8Ni
8	1	ASTM	A 666	Type 304L	S30403	—	Plate, Sheet & Strip	18Cr-8Ni
8	1	ASTM	A 666	Type 304LN	S30453	—	Plate, Sheet & Strip	18Cr-8Ni-N
8	1	ASTM	A 666	Type 304N	S30451	—	Plate, Sheet & Strip	18Cr-8Ni-N
8	1	ASTM	A 666	Type 316	S31600	—	Plate, Sheet & Strip	17Cr-12Ni-2Mo
8	1	ASTM	A 666	Type 316L	S31603	—	Plate, Sheet & Strip	16Cr-12Ni-2Mo
8	1	ASTM	A 666	Type 316N	S31651	—	Plate, Sheet & Strip	16Cr-12Ni-2Mo-N
8	1	ASTM	A 688	TP304	S30400	—	Welded Tube	18Cr-8Ni
8	1	ASTM	A 688	TP304L	S30403	—	Welded Tube	18Cr-8Ni
8	1	ASTM	A 688	TP304LN	S30453	—	Welded Tube	18Cr-8Ni-N
8	1	ASTM	A 688	TP304N	S30451	—	Welded Tube	18Cr-8Ni-N
8	1	ASTM	A 688	TP316	S31600	—	Welded Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 688	TP316L	S31603	—	Welded Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 688	TP316LN	S31653	—	Welded Tube	16Cr-12Ni-2Mo-N
8	1	ASTM	A 688	TP316N	S31651	—	Welded Tube	16Cr-12Ni-2Mo-N

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys									
8	1	ASTM	A 743	CF-3	J92500	—	70/30 [483/207]	Castings	19Cr-10Ni
8	1	ASTM	A 743	CF-8	J92600	—	70/30 [483/207]	Castings	19Cr-9.Ni
8	1	ASTM	A 743	CF-8C	J92710	—	70/30 [483/207]	Castings	19.5Cr-10.5Ni
8	1	ASTM	A 743	CF-8M	J92900	—	70/30 [483/207]	Castings	19.5Cr-10.5Ni-2.5Mo
8	1	ASTM	A 743	CF-16F	J92701	—	70/30 [483/207]	Castings	19.5Cr-10.5Ni-0.28Se
8	1	ASTM	A 743	CG-8M	J93000	—	75/35 [517/241]	Castings	19.5Cr-11Ni-3.5Mo
8	1	ASTM	A 743	CG-12	J93001	—	70/28 [483/193]	Castings	21.5Cr-11.5Ni
8	1	ASTM	A 743	CF-3M	J92800	—	70/30 [483/207]	Castings	19Cr-11Ni-2.5Mo
8	1	ASTM	A 743	CF-3MN	J92804	—	75/37 [517/255]	Castings	19.5Cr-11Ni-2.5Mo-0.15N
8	1	ASTM	A 743	CF-10SMnN	J92972	—	85/42 [586/290]	Castings	17Cr-8.5Ni-8Mn-4Si-0.12N
8	1	ASTM	A 743	CG-3M	J92999	—	75/35 [517/241]	Castings	19Cr-11Ni-3.5Mo
8	1	ASTM	A 743	CN-3M	J94652	—	63/25 [434/172]	Castings	25Ni-21Cr-05Mo
8	1	ASTM	A 774	TP304L	S30403	—	70/25 [483/172]	As Welded Wrought Fittings	18Cr-8Ni
8	1	ASTM	A 774	TP316L	S31603	—	70/25 [483/172]	As Welded Wrought Fittings	16Cr-12Ni-2Mo
8	1	ASTM	A 774	TP317L	S31703	—	75/30 [517/207]	As Welded Wrought Fittings	18Cr-13Ni-3Mo
8	1	ASTM	A 774	TP321	S32100	—	75/30 [517/207]	As Welded Wrought Fittings	18Cr-10Ni-Ti
8	1	ASTM	A 774	TP347	S34700	—	75/30 [517/207]	As Welded Wrought Fittings	18Cr-10Ni-Cb
8	1	ASTM	A 778	TP304L	S30403	—	70/25 [483/172]	Welded Unannealed Tube	18Cr-8Ni
8	1	ASTM	A 778	TP316L	S31603	—	70/25 [483/172]	Welded Unannealed Tube	16Cr-12Ni-2Mo
8	1	ASTM	A 778	TP317L	S31703	—	75/30 [517/207]	Welded Unannealed Tube	18Cr-13Ni-3Mo
8	1	ASTM	A 778	TP321	S32100	—	75/30 [517/207]	Welded Unannealed Tube	18Cr-10Ni-Ti
8	1	ASTM	A 778	TP347	S34700	—	75/30 [517/207]	Welded Unannealed Tube	18Cr-10Ni-Cb
8	1	ASTM	A 813	TPXM-15	S38100	—	75/30 [517/207]	Welded Pipe	18Cr-18Ni-2Si
8	1	ASTM	A 813	TP304	S30400	—	75/30 [517/207]	Welded Pipe	18Cr-8Ni
8	1	ASTM	A 813	TP304H	S30409	—	75/30 [517/207]	Welded Pipe	18Cr-8Ni
8	1	ASTM	A 813	TP304L	S30403	—	70/25 [483/172]	Welded Pipe	18Cr-8Ni
8	1	ASTM	A 813	TP304LN	S30453	—	75/30 [517/207]	Welded Pipe	18Cr-8Ni-N
8	1	ASTM	A 813	TP304N	S30451	—	80/35 [552/241]	Welded Pipe	18Cr-8Ni-N
8	1	ASTM	A 813	TP316	S31600	—	75/30 [517/207]	Welded Pipe	16Cr-12Ni-2Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
8	1	ASTM	TP316H	S31609	—	75/30 [517/207]	Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	TP316L	S31603	—	70/25 [483/172]	Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	TP316LN	S31653	—	75/30 [517/207]	Welded Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	TP316N	S31651	—	80/35 [552/241]	Welded Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	TP317	S31700	—	75/30 [517/207]	Welded Pipe	18Cr-13Ni-2Mo
8	1	ASTM	TP317L	S31703	—	75/30 [517/207]	Welded Pipe	18Cr-13Ni-2Mo
8	1	ASTM	TP321	S32100	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Ti
8	1	ASTM	TP321H	S32109	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Ti
8	1	ASTM	TP347	S34700	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	TP347H	S34709	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	TP348	S34800	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	TP348H	S34809	—	75/30 [517/207]	Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	S31254	S31254	—	94/44 [648/303]	Welded Pipe	20Cr-18Ni-6Mo-Cu-N
8	1	ASTM	TPXM-15	S38100	—	75/30 [517/207]	Welded Pipe	18Cr-18Ni-2Si
8	1	ASTM	TP304	S30400	—	75/30 [517/207]	Cold Worked, Welded Pipe	18Cr-8Ni
8	1	ASTM	TP304H	S30409	—	75/30 [517/207]	Cold Worked, Welded Pipe	18Cr-8Ni
8	1	ASTM	TP304L	S30403	—	70/25 [483/172]	Cold Worked, Welded Pipe	18Cr-8Ni
8	1	ASTM	TP304LN	S30453	—	75/30 [517/207]	Cold Worked, Welded Pipe	18Cr-8Ni-N
8	1	ASTM	TP304N	S30451	—	80/35 [552/241]	Cold Worked, Welded Pipe	18Cr-8Ni-N
8	1	ASTM	TP316	S31600	—	75/30 [517/207]	Cold Worked, Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	TP316H	S31609	—	75/30 [517/207]	Cold Worked, Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	TP316L	S31603	—	70/25 [483/172]	Cold Worked, Welded Pipe	16Cr-12Ni-2Mo
8	1	ASTM	TP316LN	S31653	—	75/30 [517/207]	Cold Worked, Welded Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	TP316N	S31651	—	80/35 [552/241]	Cold Worked, Welded Pipe	16Cr-12Ni-2Mo-N
8	1	ASTM	TP317	S31700	—	75/30 [517/207]	Cold Worked, Welded Pipe	18Cr-13Ni-3Mo
8	1	ASTM	TP317L	S31703	—	75/30 [517/207]	Cold Worked, Welded Pipe	18Cr-13Ni-3Mo
8	1	ASTM	TP321	S32100	—	75/30 [517/207]	Cold Worked, Welded Pipe	18Cr-10Ni-Ti
8	1	ASTM	TP321H	S32109	—	75/30 [517/207]	Cold Worked, Welded Pipe	18Cr-10Ni-Ti
8	1	ASTM	TP347	S34700	—	75/30 [517/207]	Cold Worked, Welded Pipe	18Cr-10Ni-Cb

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum		Product Form	Nominal Composition
						Tensile/Yield Strength, ksi [MPa]			
Steel and Steel Alloys									
8	1	ASTM	TP347H	S34709	—	75/30	[517/207]	Cold Worked, Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	TP348	S34800	—	75/30	[517/207]	Cold Worked, Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	TP348H	S34809	—	75/30	[517/207]	Cold Worked, Welded Pipe	18Cr-10Ni-Cb
8	1	ASTM	F304	S30400	—	70/30	[483/207]	Forging	18Cr-8Ni
8	1	ASTM	F304H	S30409	—	70/30	[483/207]	Forging	18Cr-8Ni
8	1	ASTM	F304L	S30403	—	65/25	[448/172]	Forging	18Cr-8Ni
8	1	ASTM	F304LN	S30453	—	70/30	[483/207]	Forging	18Cr-8Ni-N
8	1	ASTM	F304N	S30451	—	80/35	[552/241]	Forging	18Cr-8Ni-N
8	1	ASTM	F316	S31600	—	70/30	[483/207]	Forging	16Cr-12Ni-2Mo
8	1	ASTM	F316H	S31609	—	70/30	[483/207]	Forging	16Cr-12Ni-2Mo
8	1	ASTM	F316L	S31603	—	65/25	[448/172]	Forging	16Cr-12Ni-2Mo
8	1	ASTM	F316LN	S31653	—	70/30	[483/207]	Forging	16Cr-12Ni-2Mo-N
8	1	ASTM	F316N	S31651	—	80/35	[552/241]	Forging	16Cr-12Ni-2Mo-N
8	1	ASTM	F321	S32100	—	70/30	[483/207]	Forging	18Cr-10Ni-Ti
8	1	ASTM	F321H	S32109	—	70/30	[483/207]	Forging	18Cr-10Ni-Ti
8	1	ASTM	F347	S34700	—	70/30	[483/207]	Forging	18Cr-10Ni-Cb
8	1	ASTM	F347H	S34709	—	70/30	[483/207]	Forging	18Cr-10Ni-Cb
8	1	ASTM	F348	S34800	—	70/30	[483/207]	Forging	18Cr-10Ni-Cb
8	1	ASTM	F348H	S34809	—	65/25	[448/172]	Forging	18Cr-10Ni-Cb
8	2	ASTM	Type 308	S30800	—	75/30	[517/207]	Plate, Sheet & Strip	20Cr-10Ni
8	2	ASTM	Type 309	S30900	—	75/30	[517/207]	Plate, Sheet & Strip	20Cr-10Ni
8	2	ASTM	Type 309S	S30908	—	75/30	[517/207]	Plate, Sheet & Strip	20Cr-10Ni
8	2	ASTM	Type 310	S31000	—	75/30	[517/207]	Plate, Sheet & Strip	20Cr-10Ni
8	2	ASTM	Type 310S	S31008	—	75/30	[517/207]	Plate, Sheet & Strip	20Cr-10Ni
8	2	ASTM	F10	S33100	—	80/30	[552/207]	Pipe Flanges & Fittings	20Ni-8Cr
8	2	ASTM	F310	S31000	≤5 [125]	75/30	[517/207]	Pipe Flanges & Fittings	25Cr-20Ni
8	2	ASTM	F310	S31000	>5 [125]	70/30	[483/207]	Pipe Flanges & Fittings	25Cr-20Ni
8	2	ASTM	F45	S30815	—	87/45	[600/310]	Pipe Flanges & Fittings	21Cr-11Ni-N

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations,	Minimum Tensile/Yield Strength,	Product Form	Nominal Composition
					in [mm]	ksi [MPa]		
Steel and Steel Alloys								
8	2	ASTM	A 213	TP253MA	S30815	—	Seamless Tube	21Cr-11Ni-N
8	2	ASTM	A 213	TP310MoLN	S31050	≤0.25 [6]	Seamless Tube	25Cr-20Ni-2Mo
8	2	ASTM	A 213	TP310MoLN	S31050	>0.25 [6]	Seamless Tube	25Cr-20Ni-2Mo
8	2	ASTM	A 213	TP309Cb	S30940	—	Seamless Tube	23Cr-12Ni-Cb
8	2	ASTM	A 213	TP309S	S30908	—	Seamless Tube	23Cr-12Ni
8	2	ASTM	A 213	TP310Cb	S31040	—	Seamless Tube	25Cr-20Ni-Cb
8	2	ASTM	A 213	TP310S	S31008	—	Seamless Tube	25Cr-20Ni
8	2	ASTM	A 213	Type 309H	S30909	—	Seamless Tube	25Cr-20Ni
8	2	ASTM	A 213	Type 309HCb	S30941	—	Seamless Tube	23Cr-12Ni-Cb
8	2	ASTM	A 213	Type 310	S31000	—	Seamless Tube	25Cr-20Ni
8	2	ASTM	A 213	Type 310H	S31009	—	Seamless Tube	25Cr-20Ni
8	2	ASTM	A 213	Type 310HCb	S31041	—	Seamless Tube	25Cr-20Ni-Cb
8	2	ASTM	A 240	S30815	S30815	<3/16 [5]	Plate, Sheet & Strip	21Cr-11Ni-N
8	2	ASTM	A 240	TP310MoLN	S31050	≥3/16 [5]	Plate, Sheet & Strip	25Cr-22Ni-2Mo-N
8	2	ASTM	A 240	Type 309HCb	S30941	—	Plate, Sheet & Strip	23Cr-12Ni-Cb
8	2	ASTM	A 240	Type 309Cb	S30940	—	Plate, Sheet & Strip	23Cr-12Ni-Cb
8	2	ASTM	A 240	Type 309H	S30909	—	Plate, Sheet & Strip	23Cr-12Ni
8	2	ASTM	A 240	Type 309S	S30908	—	Plate, Sheet & Strip	23Cr-12Ni
8	2	ASTM	A 240	Type 310Cb	S31040	—	Plate, Sheet & Strip	25Cr-20Ni-Cb
8	2	ASTM	A 240	Type 310S	S31008	—	Plate, Sheet & Strip	25Cr-20Ni
8	2	ASTM	A 249	S30815	S30815	—	Welded Tube	21Cr-11Ni-N
8	2	ASTM	A 249	Type 310 MoLN	S31050	>0.25 [6]	Welded Tube	25Cr-22Ni-2Mo-N
8	2	ASTM	A 249	Type 310 MoLN	S31050	≤0.25 [6]	Welded Tube	25Cr-22Ni-2Mo-N
8	2	ASTM	A 249	TP309Cb	S30940	—	Welded Tube	23Cr-12Ni-Cb
8	2	ASTM	A 249	TP309H	S30909	—	Welded Tube	23Cr-12Ni
8	2	ASTM	A 249	TP309HCb	S30941	—	Welded Tube	23Cr-12Ni-Cb
8	2	ASTM	A 249	TP309S	S30908	—	Welded Tube	23Cr-12Ni
8	2	ASTM	A 249	TP310Cb	S31040	—	Welded Tube	25Cr-20Ni-Cb
8	2	ASTM	A 249	TP310H	S31009	—	Welded Tube	25Cr-20Ni

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
8	2	ASTM	A 249	TP310S	—	75/30 [517/207]	Welded Tube	25Cr-20Ni
8	2	ASTM	A 249	Type 309	—	75/30 [517/207]	Welded Tube	23Cr-12Ni
8	2	ASTM	A 297	HE	—	65/40 [448/276]	Castings	58Fe-28Cr-9.5Ni-2Mn-2Si
8	2	ASTM	A 297	HF	—	70/35 [483/241]	Castings	65Fe-20.5Cr-10Ni-2Mn-2Si
8	2	ASTM	A 297	HH	—	75/35 [517/241]	Castings	57Fe-26Cr-12.5Ni-2Mn-2Si
8	2	ASTM	A 297	HI	—	70/35 [483/241]	Castings	51Fe-28Cr-16Ni-2Mn-2Si
8	2	ASTM	A 297	HK	—	65/35 [448/241]	Castings	49Fe-26Cr-20Ni-2Mn-2Si
8	2	ASTM	A 312	S30815	—	87/45 [600/310]	Seamless & Welded Pipe	21Cr-11Ni-N
8	2	ASTM	A 312	TP309Cb	—	75/30 [517/207]	Seamless & Welded Pipe	23Cr-12Ni-Cb
8	2	ASTM	A 312	TP309H	—	75/30 [517/207]	Seamless & Welded Pipe	23Cr-12Ni
8	2	ASTM	A 312	TP309HCb	—	75/30 [517/207]	Seamless & Welded Pipe	23Cr-12Ni-Cb
8	2	ASTM	A 312	TP309S	—	75/30 [517/207]	Seamless & Welded Pipe	23Cr-12Ni
8	2	ASTM	A 312	TP310Cb	—	75/30 [517/207]	Seamless & Welded Pipe	25Cr-20Ni-Cb
8	2	ASTM	A 312	TP310H	—	75/30 [517/207]	Seamless & Welded Pipe	25Cr-20Ni
8	2	ASTM	A 312	TP310HCb	—	75/30 [517/207]	Seamless & Welded Pipe	25Cr-20Ni-Cb
8	2	ASTM	A 312	TP310MoLN	≤0.25 [6]	78/37 [538/255]	Welded Pipe	25Cr-22Ni-2Mo-N
8	2	ASTM	A 312	TP310MoLN	>0.25 [6]	84/39 [579/269]	Welded Pipe	25Cr-22Ni-2Mo-N
8	2	ASTM	A 312	TP310S	—	75/30 [517/207]	Seamless & Welded Pipe	25Cr-20Ni
8	2	ASTM	A 336	F310	—	75/30 [517/207]	Forging	25Cr-20Ni
8	2	ASTM	A 351	CE20N	—	80/40 [552/276]	Castings	25Cr-8Ni-N
8	2	ASTM	A 351	CH10	—	70/30 [483/207]	Castings	25Cr-12Ni
8	2	ASTM	A 351	CH20	—	70/30 [483/207]	Castings	25Cr-12Ni
8	2	ASTM	A 351	CH8	—	65/28 [448/193]	Castings	25Cr-12Ni
8	2	ASTM	A 351	CK20	—	65/28 [448/193]	Castings	25Cr-20Ni
8	2	ASTM	A 351	HK40	—	62/35 [427/241]	Castings	25Cr-20Ni-5Mo
8	2	ASTM	A 358	309	—	75/90 [517/621]	Welded Pipe	23Cr-12Ni
8	2	ASTM	A 358	309Cb	—	75/30 [517/207]	Welded Pipe	23Cr-12Ni-Cb
8	2	ASTM	A 358	309S	—	75/30 [517/207]	Welded Pipe	23Cr-12Ni
8	2	ASTM	A 358	310	—	75/30 [517/207]	Welded Pipe	25Cr-20Ni

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
8	2	ASTM	A 358	310Cb	—	75/30 [517/207]	Welded Pipe	25Cr-20Ni-Cb
8	2	ASTM	A 358	310S	—	75/30 [517/207]	Welded Pipe	25Cr-20Ni
8	2	ASTM	A 358	253MA	—	87/45 [600/310]	Welded Pipe	21Cr-11Ni-N
8	2	ASTM	A 403	WP309	—	75/30 [517/207]	Pipe Fittings	23Cr-12Ni
8	2	ASTM	A 403	WP310	—	75/30 [517/207]	Pipe Fittings	25Cr-20Ni
8	2	ASTM	A 409	253MA	—	87/45 [600/310]	Welded Pipe	21Cr-11Ni-N
8	2	ASTM	A 409	TP309Cb	—	75/30 [517/207]	Welded Pipe	23Cr-12Ni-Cb
8	2	ASTM	A 473	Type 308	—	75/30 [517/207]	Forging	20Cr-10Ni
8	2	ASTM	A 473	Type 314	—	75/30 [517/207]	Forging	25Cr-21Ni-Si
8	2	ASTM	A 511	MT 309S	—	75/30 [515/210]	Welded Tube	20Cr-10Ni
8	2	ASTM	A 511	MT 310S	—	75/30 [515/210]	Welded Tube	20Cr-10Ni
8	2	ASTM	A 554	MT 309S	—	75/30 [515/210]	Welded Tube	20Cr-10Ni
8	2	ASTM	A 554	MT 309S-Cb	—	75/30 [515/210]	Welded Tube	20Cr-10Ni-Cb
8	2	ASTM	A 554	MT 310S	—	75/30 [515/210]	Welded Tube	20Cr-10Ni
8	2	ASTM	A 743	CH-20	—	70/30 [483/207]	Castings	24Cr-13.5Ni
8	2	ASTM	A 743	CF-20	—	70/30 [483/207]	Castings	19.5Cr-9.5Ni
8	2	ASTM	A 743	CK-20	—	65/28 [448/193]	Castings	25Cr-20.5Ni
8	2	ASTM	A 743	CH-10	—	70/30 [483/207]	Castings	24Cr-13.5Ni
8	2	ASTM	A 965	F310	—	75/30 [517/207]	Forging	25Cr-20Ni
8	3	ASTM	A 182	FXM-11	—	90/50 [621/345]	Pipe Flanges & Fittings	21Cr-6Ni-9Mn
8	3	ASTM	A 182	FXM-19	—	100/55 [689/379]	Pipe Flanges & Fittings	22Cr-13Ni-5Mn
8	3	ASTM	A 213	TP201	—	95/50 [655/345]	Seamless Tube	17Cr-4Ni-6Mn
8	3	ASTM	A 213	TP202	—	90/45 [621/310]	Seamless Tube	18Cr-5Ni-9Mn
8	3	ASTM	A 240	S21800	—	95/50 [655/345]	Plate, Sheet & Strip	18Cr-8Ni-4Si-N
8	3	ASTM	A 240	Type 201-1	—	95/38 [655/262]	Plate, Sheet & Strip	17Cr-4Ni-6Mn
8	3	ASTM	A 240	Type 202	—	90/38 [621/262]	Plate, Sheet & Strip	18Cr-5Ni-9Mn
8	3	ASTM	A 240	Type XM-17	≤3/16 [5]	100/60 [689/414]	Sheet & Strip	19Cr-6Mn-6Ni-Mo-N
8	3	ASTM	A 240	Type XM-17	>3/16 [5]	90/50 [621/345]	Plate	19Cr-6Mn-6Ni-Mo-N

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
8	3	ASTM	A 240	Type XM-18	S21603	≤3/16 [5]	100/60 [689/414]	Sheet & Strip	19Cr-6Mn-6Ni-Mo-N
8	3	ASTM	A 240	Type XM-18	S21603	>3/16 [5]	90/50 [621/345]	Plate	19Cr-6Mn-6Ni-Mo-N
8	3	ASTM	A 240	Type XM-19	S20910	≤3/16 [5]	105/60 [724/414]	Sheet & Strip	22Cr-13Ni-5Mn
8	3	ASTM	A 240	Type XM-19	S20910	>3/16 [5]	100/55 [689/379]	Plate	22Cr-13Ni-5Mn
8	3	ASTM	A 240	Type XM-29	S24000	≤3/16 [5]	100/60 [689/414]	Sheet & Strip	18Cr-3Ni-12Mn
8	3	ASTM	A 240	Type XM-29	S24000	>3/16 [5]	100/55 [689/379]	Plate	18Cr-3Ni-12Mn
8	3	ASTM	A 249	TP201	S20100	—	95/38 [655/262]	Welded Tube	17Cr-4Ni-6Mn
8	3	ASTM	A 249	TP202	S20200	—	90/38 [621/262]	Welded Tube	18Cr-5Ni-9Mn
8	3	ASTM	A 249	TPXM-19	S20910	—	100/55 [689/379]	Welded Tube	22Cr-13Ni-5Mn
8	3	ASTM	A 249	TPXM-29	S24000	—	100/55 [689/379]	Welded Tube	18Cr-3Ni-12Mn
8	3	ASTM	A 269	Type XM-10	S21900	—	90/50 [621/345]	Tube	20Cr-6Ni-9Mn
8	3	ASTM	A 269	Type XM-11	S21904	—	90/50 [621/345]	Tube	21Cr-6Ni-9Mn
8	3	ASTM	A 269	Type XM-15	S38100	—	90/50 [621/345]	Tube	18Cr-18Ni-9i
8	3	ASTM	A 269	Type XM-19	S20910	—	100/55 [689/379]	Tube	22Cr-13Ni-7Mn
8	3	ASTM	A 269	Type XM-29	S24000	—	100/55 [689/379]	Tube	18Cr-3Ni-12Mn
8	3	ASTM	A 312	TPXM-29	S24000	—	100/55 [689/379]	Seamless & Welded Pipe	18Cr-3Ni-12Mn
8	3	ASTM	A 312	TP-11	S21904	—	90/50 [621/345]	Seamless & Welded Pipe	21Cr-6Ni-9Mn
8	3	ASTM	A 312	FMX-19	S20910	—	100/55 [689/379]	Seamless & Welded Pipe	22Cr-13Ni-5Mn
8	3	ASTM	A 336	FXM-11	S21904	—	90/50 [621/345]	Forging	21Cr-6Ni-9Mn
8	3	ASTM	A 336	FXM-19	S20910	—	100/55 [689/379]	Forging	22Cr-13Ni-5Mn
8	3	ASTM	A 351	CG6MMN	J93790	—	85/42 [586/290].5	Castings	22Cr-12Ni-5Mn
8	3	ASTM	A 358	XM-19	S22100	—	100/55 [689/379]	Welded Pipe	22Cr-13Ni-5Mn
8	3	ASTM	A 358	XM-29	S28300	—	100/55 [689/379]	Welded Pipe	18Cr-3Ni-12Mn
8	3	ASTM	A 403	WPXM-19	S20910	—	100/55 [689/379]	Pipe Fittings	22Cr-13Ni-5Mn
8	3	ASTM	A 473	Type 202	S20200	—	90/45 [621/310]	Forging	18Cr-5Ni-9Mn
8	3	ASTM	A 473	Type XM-10	S21900	—	90/50 [621/345]	Forging	20Cr-6Ni-9Mn
8	3	ASTM	A 473	Type XM-11	S21904	—	90/50 [621/345]	Forging	21Cr-6Ni-9Mn
8	3	ASTM	A 479	Type 218	S21800	—	95/50 [655/345]	Bars & Shapes	18Cr-8Ni-4Si-N
8	3	ASTM	A 479	XM-11	S21904	—	90/50 [621/345]	Bars & Shapes	21Cr-6Ni-9Mn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
8	3	ASTM	A 479	XM-17	—	90/50 [621/345]	Bars & Shapes	19Cr-8Mn-6Ni-Mo
8	3	ASTM	A 479	XM-18	—	90/50 [621/345]	Bars & Shapes	19Cr-8Mn-6Ni-Mo
8	3	ASTM	A 479	XM-19	—	100/55 [689/379]	Bars & Shapes	22Cr-13Ni-5Mn
8	3	ASTM	A 479	XM-29	—	100/55 [689/379]	Bars & Shapes	18Cr-3Ni-12Mn
8	3	ASTM	A 666	XM-11	>0.25 [6]	90/50 [621/345]	Plate	21Cr-6Ni-9Mn
8	3	ASTM	A 666	XM-11	≤0.25 [6]	100/60 [689/414]	Sheet & Strip	21Cr-6Ni-9Mn
8	3	ASTM	A 666	201	—	75/38 [517/262]	Plate, Sheet & Strip	17Cr-4Ni-6Mn
8	3	ASTM	A 688	XM-29	—	100/55 [689/379]	Welded Tube	18Cr-3Ni-12Mn
8	3	ASTM	A 743	CG-6MMN	—	85/42 [586/290]	Castings	22Cr-12.5Ni-Mn-2.25Mo-Cb-V-N
8	3	ASTM	A 813	TPXM-11	—	90/50 [621/345]	Welded Pipe	21Cr-6Ni-9Mn
8	3	ASTM	A 813	TPXM-19	—	100/55 [689/379]	Welded Pipe	22Cr-13Ni-5Mn
8	3	ASTM	A 813	TPXM-29	—	100/55 [689/379]	Welded Pipe	18Cr-3Ni-12Mn
8	3	ASTM	A 814	TPXM-11	—	90/50 [621/345]	Cold Worked, Welded Pipe	21Cr-6Ni-9Mn
8	3	ASTM	A 814	TPXM-19	—	100/55 [689/379]	Cold Worked, Welded Pipe	22Cr-13Ni-5Mn
8	3	ASTM	A 814	TPXM-29	—	100/55 [689/379]	Cold Worked, Welded Pipe	18Cr-3Ni-12Mn
8	3	ASTM	A 965	FXM-11	—	90/50 [621/345]	Forging	21Cr-6Ni-9Mn
8	3	ASTM	A 965	FXM-19	—	100/55 [689/379]	Forging	22Cr-13Ni-5Mn
8	4	ASTM	A 182	F44	—	94/44 [648/303]	Pipe Flanges & Fittings	20Cr-18Ni-6Mo-Cu
8	4	ASTM	A 213	317LM	—	75/30 [517/207]	Seamless Tube	19Cr-15Ni-4Mo
8	4	ASTM	A 213	317LMN	—	80/35 [552/241]	Seamless Tube	19Cr-15.5Ni-4Mo
8	4	ASTM	A 240	S31254	—	94/44 [648/303]	Plate, Sheet & Strip	20Cr-18Ni-6Mo
8	4	ASTM	A 240	317LM	—	75/30 [517/207]	Plate, Sheet & Strip	19Cr-15Ni-4Mo
8	4	ASTM	A 240	317LMN	—	80/35 [552/241]	Plate, Sheet & Strip	19Cr-15.5Ni-4Mo
8	4	ASTM	A 249	S31254	≤0.187 [5]	98/45 [676/310]	Welded Tube	20Cr-18Ni-6Mo
8	4	ASTM	A 249	S31254	>0.187 [5]	95/45 [655/310]	Welded Tube	20Cr-18Ni-6Mo
8	4	ASTM	A 249	317LM	—	75/30 [517/207]	Welded Tube	19Cr-15Ni-4Mo
8	4	ASTM	A 249	317LH	—	80/35 [552/241]	Welded Tube	19Cr-15.5Ni-4Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
8	4	ASTM	A 312	S31254	—	94/44 [648/303]	Seamless & Welded Pipe	20Cr-18Ni-6Mo
8	4	ASTM	A 312	S31725	—	75/30 [517/207]	Seamless & Welded Pipe	19Cr-15Ni-4Mo
8	4	ASTM	A 312	S31726	—	80/35 [552/241]	Seamless & Welded Pipe	19Cr-15.5Ni-4Mo
8	4	ASTM	A 336	S30600	—	78/32 [538/221]	Forging	17Cr-14Ni-4Si
8	4	ASTM	A 358	S31254	—	94/44 [648/303]	Welded Pipe	20Cr-18Ni-6Mo
8	4	ASTM	A 358	S31725	—	75/30 [517/207]	Welded Pipe	19Cr-15Ni-4Mo
8	4	ASTM	A 358	S31726	—	80/35 [552/241]	Welded Pipe	19Cr-15.5Ni-4Mo
8	4	ASTM	A 376	S31725	—	75/30 [517/207]	Seamless Tube	19Cr-15Ni-4Mo
8	4	ASTM	A 376	S31726	—	80/35 [552/241]	Seamless Tube	19Cr-15.5Ni-4Mo
8	4	ASTM	A 409	S31254	—	94/44 [648/303]	Welded Pipe	20Cr-18Ni-6Mo
8	4	ASTM	A 409	S31725	—	75/30 [517/207]	Welded Pipe	19Cr-15Ni-4Mo
8	4	ASTM	A 409	S31726	—	80/35 [552/241]	Welded Pipe	19Cr-15.5Ni-4Mo
8	4	ASTM	A 479	S31254	—	94/44 [648/303]	Bars & Shapes	20Cr-18Ni-6Mo
8	4	ASTM	A 479	S31725	—	75/30 [517/207]	Bars & Shapes	19Cr-15Ni-4Mo
8	4	ASTM	A 479	S31726	—	80/35 [552/241]	Bars & Shapes	19Cr-15Ni-4Mo
8	4	ASTM	A 743	CK-3MCuN	—	80/38 [552/262]	Castings	20Cr-18.5Ni-6.5Mo-0.75Cu-N
8	4	ASTM	A 813	S31254	—	94/44 [648/303]	Welded pipe	20Cr-18Ni-6Mo-Cu-N
8	4	ASTM	A 965	F46	—	78/32 [538/221]	Forging	17Cr-14Ni-4Si
9A	1	ASTM	A 182	Grade FR	K22035	63/46 [434/317]	Pipe Flanges & Fittings	2Ni-1Cu
9A	1	ASTM	A 203	Grade A	K21703	65/37 [448/255]	Plate	2.5Ni
9A	1	ASTM	A 203	Grade B	K22103	70/40 [483/276]	Plate	2.5Ni
9A	1	ASTM	A 234	Grade WPR	K22035	63/46 [434/317]	Pipe Fittings	2Ni-1Cu
9A	1	ASTM	A 333	Grade 7	K21903	65/35 [448/241]	Pipe	2.5Ni
9A	1	ASTM	A 333	Grade 9	K22035	63/46 [434/317]	Pipe	2Ni-1Cu
9A	1	ASTM	A 334	Grade 7	K21903	65/35 [448/241]	Tube	2.5Ni
9A	1	ASTM	A 334	Grade 9	K22035	63/46 [434/317]	Tube	2Ni-1Cu
9A	1	ASTM	A 350	Grade LF9	K22036	63/46 [434/317]	Forging	2Ni-1Cu
9A	1	ASTM	A 350	Grade LF5, Class 1	K13050	60/30 [414/207]	Forging	1.5Ni

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys									
9A	1	ASTM	A 350	Grade LF5, Class 2	K 13050	—	70/37.5 [483/259]	Forging	1.5Ni
9A	1	ASTM	A 352	Grade LC2	J22500	—	70/40 [483/276]	Castings	2.5Ni
9A	1	ASTM	A 420	Grade WPL9	K22035	—	63/46 [434/317]	Pipe Fittings	2Ni-1Cu
9A	1	ASTM	A 714	Grade V, Type E	K22035	—	65/46 [448/317]	Welded Pipe	2Ni-1Cu
9B	1	ASTM	A 203	Grade D	K31718	—	65/37 [448/255]	Plate	3.5Ni
9B	1	ASTM	A 203	Grade E	K32018	—	70/40 [483/276]	Plate	3.5Ni
9B	1	ASTM	A 203	Grade F	K30018	≤2.0 [50]	80/55 [552/379]	Plate	3.5Ni
9B	1	ASTM	A 203	Grade F	K32018	>2.0 [50]	75/50 [517/345]	Plate	3.5Ni
9B	1	ASTM	A 333	Grade 3	K31918	—	65/35 [448/241]	Pipe	3.5Ni
9B	1	ASTM	A 334	Grade 3	K31918	—	65/35 [448/241]	Tube	3.5Ni
9B	1	ASTM	A 350	Grade LF3, Class 2	K32025	—	70/37.5 [483/259]	Forging	3.5Ni
9B	1	ASTM	A 352	Grade LC3	J31550	—	70/40 [483/276]	Castings	3.5Ni
9B	1	ASTM	A 420	Grade WPL3	—	—	65/35 [448/241]	Pipe Fittings	3.5Ni
9B	1	ASTM	A 707	Grade L7, Class 1	K32218	—	60/42 [414/290]	Forging	3.45Ni
9B	1	ASTM	A 707	Grade L7, Class 2	K32218	—	66/52 [455/359]	Forging	3.45Ni
9B	1	ASTM	A 765	Grade III	K32026	—	70/37.5 [483/259]	Forging	3.5Ni
9C	1	ASTM	A 352	Grade LC4	J41500	—	70/40 [483/276]	Castings	4.5Ni
10A	1	ASTM	A 225	Grade C	K 12524	—	105/70 [724/483]	Plate	Mn-0.5Ni-V
10A	1	ASTM	A 225	Grade D	—	≤3.0 [75]	80/60 [552/414]	Plate	Mn-0.5Ni-V
10A	1	ASTM	A 225	Grade D	—	>3.0 ≤6.0 [75 ≤150]	75/55 [517/379]	Plate	Mn-0.5Ni-V
10A	1	ASTM	A 487	Grade 1, Class A	J13002	—	85/55 [586/379]	Castings	Mn-V
10A	1	ASTM	A 487	Grade 1, Class B	J13002	—	90/65 [621/448]	Castings	Mn-V
10B	1	ASTM	A 213	Grade T17	K 12047	—	60/30 [414/207]	Seamless Tube	ICr-V
10C	1	ASTM	A 612	—	K02900	≤0.5 [13]	83/50 [572/345]	Plate	C-Mn-Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition	
Steel and Steel Alloys									
10C	1	ASTM	A 612	—	K02900	>0.5 [13]	81/50 [558/345]	Plate	C-Mn-Si
10C	1	ASTM	A 841	TMCP, Class I	—	>2.5 ≤4.0 [>64 ≤100]	65/45 [448/310]	Plate	C-Mn-Si+X
10C	1	ASTM	A 841	TMCP, Class I	—	≤2.5 [64]	70/50 [483/345]	Plate	C-Mn-Si+X
10F	1	ASTM	A 487	Grade 2, Class A	J13005	—	85/53 [586/365]	Castings	Mn-0.25Mo-V
10F	1	ASTM	A 487	Grade 2, Class B	J13005	—	90/65 [621/448]	Castings	Mn-0.25Mo-V
10F	1	ASTM	A 487	Grade 4, Class C	J13047	—	90/60 [621/414]	Castings	0.5Ni-0.5Cr-0.25Mo-V
10H	1	ASTM	A 182	F50	S31200	—	100/65 [689/448]	Pipe Flanges & Fittings	25Cr-6Ni-Mo-N
10H	1	ASTM	A 182	F51	S31803	—	90/65 [621/448]	Pipe Flanges & Fittings	22Cr-5Ni-3Mo-N
10H	1	ASTM	A 182	F53	S32750	—	116/90 [800/621]	Flanges & Fittings	25Cr-7Ni-4Mo-N
10H	1	ASTM	A 182	F55	S32760	—	109/80 [752/552]	Flanges & Fittings	25Cr-8Ni-3Mo-W-Cu-N
10H	1	ASTM	A 182	F60	S32205	—	95/70 [655/483]	Flanges & Fittings	22.5Cr-5.5Ni-3.25Mo-N
10H	1	ASTM	A 182	F61	S32250	—	109/80 [752/552]	Flanges & Fittings	26Cr-5Ni-3.5Mo-2Cu-N
10H	1	ASTM	A 240	Type 255	S32550	—	110/80 [758/552]	Plate, Sheet & Strip	26Cr-5Ni-3.5Mo-2Cu-N
10H	1	ASTM	A 240	Type 329	S32900	—	90/70 [621/483]	Plate, Sheet & Strip	26Cr-4Ni-Mo
10H	1	ASTM	A 240	S31200	S31200	—	100/65 [689/448]	Plate, Sheet & Strip	25Cr-6Ni-Mo-N
10H	1	ASTM	A 240	S31260	S31260	—	100/70 [689/483]	Plate, Sheet & Strip	25Cr-6Ni-3Mo
10H	1	ASTM	A 240	S31803	S31803	—	90/65 [621/448]	Plate, Sheet & Strip	22Cr-5Ni-3Mo-N
10H	1	ASTM	A 240	S32205	S32205	—	95/65 [655/448]	Plate, Sheet & Strip	22.5Cr-5.5Ni-3.25Mo-N
10H	1	ASTM	A 240	S32950	S32950	—	100/70 [689/483]	Plate	26Cr-4Ni-Mn-N
10H	1	ASTM	A 240	—	S32101	t ≤ 0.187 [5]	101/77 [696/531]	Plate, Sheet & Strip	21.5Cr-5Mn-1.5Ni-Cu-N
10H	1	ASTM	A 240	—	S32101	t > 0.187 [5]	94/65 [648/448]	Plate, Sheet & Strip	21.5Cr-5Mn-1.5Ni-Cu-N
10H	1	ASTM	A 240	—	S32750	—	116/90 [800/621]	Plate, Sheet & Strip	25Cr-7Ni-4Mo-N
10H	1	ASTM	A 240	—	S32760	—	109/80 [752/552]	Plate, Sheet & Strip	25Cr-8Ni-3Mo-W-Cu-N
10H	1	ASTM	A 276	—	S32101	—	94/65 [648/448]	Bars & Shapes	21.5Cr-5Mn-1.5Ni-Cu-N
10H	1	ASTM	A 276	—	S32205	—	95/65 [655/448]	Bars & Shapes	22.5Cr-5.5Ni-3.25Mo-N
10H	1	ASTM	A 276	—	S32550	—	109/80 [752/552]	Bars & Shapes	26Cr-5Ni-3.5Mo-2Cu-N
10H	1	ASTM	A 351	CD4MCu	J93370	—	100/70 [689/483]	Castings	26Cr-5Ni-3Mo-2Cu

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
10H	1	ASTM	A 351	CE8MN	J93345	95/65 [655/448]	Castings	24Cr-10Ni-3Mo
10H	1	ASTM	A 351	CD3MWCuN	J93380	100/70 [689/483]	Castings	25Cr-8Ni-3Mo-W-Cu-N
10H	1	ASTM	A 479	F255	S32550	110/80 [758/552]	Bars & Shapes	26Cr-5Ni-3Cu-2Mo
10H	1	ASTM	A 479	—	S31803	90/65 [621/448]	Bars & Shapes	22Cr-5Ni-3Mo-N
10H	1	ASTM	A 479	—	S32101	94/65 [648/448]	Bar & Shapes	21.5Cr-5Mn-1.5Ni-Cu-N
10H	1	ASTM	A 479	—	S32205	95/65 [655/448]	Bar & Shapes	22.5Cr-5.5Ni-3.25Mo-N
10H	1	ASTM	A 479	—	S32550	110/80 [758/552]	Bar & Shapes	26Cr-5Ni-3.5Mo-2Cu-N
10H	1	ASTM	A 789	S31200	S31200	100/65 [689/448]	Seamless & Welded Tube	25Cr-6Ni-Mo-N
10H	1	ASTM	A 789	—	S32101	t ≤ 0.187 [5]	Tubing	21.5Cr-5Mn-1.5Ni-Cu-N
10H	1	ASTM	A 789	—	S32101	t > 0.187 [5]	Tubing	21.5Cr-5Mn-1.5Ni-Cu-N
10H	1	ASTM	A 789	—	S32205	95/70 [655/483]	Tubing	22.5Cr-5.5Ni-3.25Mo-N
10H	1	ASTM	A 789	—	S32550	110/80 [758/552]	Tubing	26Cr-5Ni-3.5Mo-2Cu-N
10H	1	ASTM	A 789	—	S32760	109/80 [752/552]	Tubing	25Cr-8Ni-3Mo-W-Cu-N
10H	1	ASTM	A 789	Grade 2950	S32950	100/70 [689/483]	Seamless & Welded Tube	26Cr-4Ni-Mo-N
10H	1	ASTM	A 789	Grade 2304	S32304	>1.0 [25] O.D.	Seamless & Welded Tube	23Cr-4Ni-Mo-Cu-N
10H	1	ASTM	A 789	Grade 2304	S32304	≤1.0 [25] O.D.	Seamless & Welded Tube	23Cr-4Ni-Mo-Cu-N
10H	1	ASTM	A 789	Grade 2550	S32550	110/80 [758/552]	Seamless & Welded Tube	25Cr-5Ni-3Cu-2Mo
10H	1	ASTM	A 789	Grade S32750	S32750	116/80 [800/552]	Seamless & Welded Tube	25Cr-7Ni-4Mo-N
10H	1	ASTM	A 789	S31500	S31500	92/64 [634/441]	Seamless & Welded Tube	18Cr-5Ni-3Mo-N
10H	1	ASTM	A 789	Grade S32900	S32900	90/70 [621/483]	Seamless & Welded Tube	26Cr-4Ni-Mo
10H	1	ASTM	A 789	Grade S31803	S31803	90/65 [621/448]	Seamless & Welded Tube	22Cr-5Ni-3Mo-N
10H	1	ASTM	A 789	S31260	S31260	100/65 [689/448]	Seamless & Welded Tube	25Cr-6Ni-3Mo-N
10H	1	ASTM	A 790	Grade S31200	S31200	100/65 [689/448]	Seamless & Welded Tube	25Cr-6Ni-Mo-N
10H	1	ASTM	A 790	Grade S31260	S31260	100/65 [689/448]	Seamless & Welded Tube	25Cr-6Ni-3Mo-N
10H	1	ASTM	A 790	Grade S31500	S31500	92/64 [634/441]	Seamless & Welded Tube	18Cr-5Ni-3Mo-N
10H	1	ASTM	A 790	Grade S31803	S31803	90/65 [621/448]	Seamless & Welded Tube	22Cr-5Ni-3Mo-N
10H	1	ASTM	A 790	Grade S32304	S32304	87/58 [600/400]	Seamless & Welded Tube	29Cr-4Ni-Mo-Cu-N
10H	1	ASTM	A 790	Grade S32550	S32550	110/80 [758/552]	Seamless & Welded Tube	25Cr-5Ni-3Cu-2Mo
10H	1	ASTM	A 790	Grade S32750	S32750	116/80 [800/552]	Seamless & Welded Tube	25Cr-7Ni-4Mo-N

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
10H 1	ASTM	A 790	Grade S32900	S32900	—	90/70 [621/483]	Seamless & Welded Tube	26Cr-4Ni-Mo
10H 1	ASTM	A 790	Grade S32900	S32900	—	90/70 [621/483]	Tube	26Cr-4Ni-Mo
10H 1	ASTM	A 790	Grade S32950	S32950	—	100/70 [689/483]	Seamless & Welded Tube	26Cr-4Ni-Mo-N
10H 1	ASTM	A 790	—	S32101	t ≤ 0.187 [5]	101/77 [696/531]	Seamless & Welded Pipe	21.5Cr-5Mn-1.5Ni-Cu-N
10H 1	ASTM	A 790	—	S32101	t > 0.187 [5]	94/65 [648/448]	Seamless & Welded Pipe	21.5Cr-5Mn-1.5Ni-Cu-N
10H 1	ASTM	A 790	—	S32205	—	95/65 [655/448]	Seamless & Welded Pipe	22.5Cr-5.5Ni-3.25Mo-N
10H 1	ASTM	A 790	—	S32550	—	110/80 [758/552]	Seamless & Welded Pipe	26Cr-5Ni-3.5Mo-2Cu-N
10H 1	ASTM	A 790	—	S32760	—	109/80 [752/552]	Seamless & Welded Pipe	25Cr-8Ni-3Mo-W-Cu-N
10H 1	ASTM	A 815	S31803	S31803	—	90/65 [621/448]	Wrought Pipe Fittings	22Cr-5Ni-3Mo-N
10H 1	ASTM	A 815	S32205	S32205	—	95/70 [655/483]	Wrought Pipe Fittings	22.5Cr-5.5Ni-3.25Mo-N
10H 1	ASTM	A 815	S32550	S32550	—	110/80 [758/552]	Welded Pipe Fittings	26Cr-5Ni-3.5Mo-2Cu-N
10H 1	ASTM	A 815	S32760	S32760	—	109/80 [752/552]	Wrought Pipe Fittings	25Cr-8Ni-3Mo-W-Cu-N
10H 1	ASTM	A 890	1A	J93370	—	100/70 [689/483]	Casting	25.5Cr-5.25Ni-2Mo-3Cu
10H 1	ASTM	A 890	1B	J93372	—	100/70 [689/483]	Casting	25.5Cr-5Ni-2Mo-3Cu-N
10H 1	ASTM	A 890	1C	J93373	—	100/65 [689/448]	Casting	25.25Cr-6Ni-3.5Mo-1.75Cu-N
10H 1	ASTM	A 890	2A	J93345	—	95/65 [655/448]	Casting	24Cr-10Ni-3.75Mo-N
10H 1	ASTM	A 890	3A	J93371	—	95/65 [655/448]	Casting	25.5Cr-5Ni-2Mo-N
10H 1	ASTM	A 890	4A	J92205	—	90/60 [621/414]	Casting	22.25-5.5Ni-3Mo-N
10H 1	ASTM	A 890	5A	J93404	—	100/75 [689/517]	Casting	25Cr-7Ni-4.5Mo-N
10H 1	ASTM	A 890	6A	J93380	—	100/65 [689/448]	Casting	25Cr-7.5Ni-3.5Mo-25N
10H 1	ASTM	A 928	255	S32550	—	110/80 [758/552]	Welded Pipe	26Cr-5Ni-3.5Mo-2Cu-N
10H 1	ASTM	A 928	2205	S32205	—	95/65 [655/448]	Welded Pipe	22.5Cr-5.5Ni-3.25Mo-N
10H 1	ASTM	A 928	—	S32760	—	109/80 [752/552]	Welded Pipe	25Cr-8Ni-3Mo-W-Cu-N
10H 1	ASTM	A 995	1B	J93372	—	100/70 [689/483]	Casting	25.5Cr-5Ni-2Mo-3Cu-N
10H 1	ASTM	A 995	2A	J93345	—	95/65 [655/448]	Casting	24Cr-10Ni-3.75Mo-N
10H 1	ASTM	A 995	3A	J93371	—	95/65 [655/448]	Casting	25.5Cr-5Ni-2Mo-N
10H 1	ASTM	A 995	4A	J92205	—	90/60 [621/414]	Casting	22.25-5.5Ni-3Mo-N
10H 1	ASTM	A 995	5A	J93404	—	100/75 [689/517]	Casting	25Cr-7Ni-4.5Mo-N

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
10H	1	ASTM	A 995	6A	J93380	100/65 [689/448]	Casting	25Cr-7.5Ni-3.5Mo-.25N
10I	1	ASTM	A 182	Grade FXM-27Cb	S44627	60/35 [414/241]	Pipe Flanges & Fittings	27Cr-1Mo
10I	1	ASTM	A 240	S44635	S44635	90/75 [621/517]	Plate, Sheet & Strip	25Cr-4Ni-4Mo-Ti
10I	1	ASTM	A 240	Type XM-33	S44626	68/45 [469/310]	Plate, Sheet & Strip	27Cr-1Mo-Ti
10I	1	ASTM	A 240	Type XM-27	S44627	65/40 [448/276]	Plate, Sheet & Strip	27Cr-1Mo
10I	1	ASTM	A 268	Type 446-1	S44600	70/40 [483/276]	Seamless & Welded Tube	27Cr
10I	1	ASTM	A 268	Type 446-2	S44600	65/40 [448/276]	Seamless & Welded Tube	27Cr
10I	1	ASTM	A 268	25-4-4	S44635	90/75 [621/517]	Seamless & Welded Tube	25Cr-4Ni-4Mo-Ti
10I	1	ASTM	A 268	TPXM-33	S44626	68/45 [469/310]	Seamless & Welded Tube	27Cr-1Mo-Ti
10I	1	ASTM	A 268	TPXM-27	S44627	65/40 [448/276]	Seamless & Welded Tube	27Cr-1Mo
10I	1	ASTM	A 336	Grade FXM-27 Cb	S44627	60/35 [414/241]	Forging	27Cr-1Mo
10I	1	ASTM	A 479	Type XM-27	S44627	65/40 [448/276]	Bars & Shapes	27Cr-1Mo
10I	1	ASTM	A 731	Grade TPXM-27	S44627	65/40 [448/276]	Seamless & Welded Pipe	27Cr-1Mo
10I	1	ASTM	A 731	Grade TPXM-33	S44626	65/40 [448/276]	Seamless & Welded Pipe	27Cr-1Mo-Ti
10J	1	ASTM	A 240	Grade 29-4	S44700	80/60 [552/414]	Plate, Sheet & Strip	29Cr-4Mo
10J	1	ASTM	A 268	Grade 29-4	S44700	80/60 [552/414]	Seamless & Welded Pipe	29Cr-4Mo
10J	1	ASTM	A 268	S44735	S44735	75/60 [517/414]	Seamless & Welded Pipe	29Cr-4Mo-Ti
10J	1	ASTM	A 479	Grade 28	S44700	70/55 [483/379]	Bars & Shapes	29Cr-4Mo
10J	1	ASTM	A 731	S44700	S44700	80/60 [552/414]	Seamless & Welded Pipe	29Cr-4Mo
10K	1	ASTM	A 240	S44660	S44660	85/65 [586/448]	Plate	26Cr-3Ni-3Mo
10K	1	ASTM	A 240	Grade S44800	S44800	80/60 [552/414]	Plate	29Cr-4Mo-2Ni
10K	1	ASTM	A 268	Grade 26-3-3	S44660	85/65 [586/448]	Seamless & Welded Tube	26Cr-3Ni-3Mo
10K	1	ASTM	A 268	Grade 29-4-2	S44800	80/60 [552/414]	Seamless & Welded Tube	29Cr-4Mo-2Ni
10K	1	ASTM	A 479	Grade 28-4-2	S44800	80/60 [552/414]	Bars & Shapes	29Cr-4Mo-2Ni
10K	1	ASTM	A 731	Grade 26-3-3	S44660	85/65 [586/448]	Seamless & Welded Tube	26Cr-3Ni-3Mo
10K	1	ASTM	A 731	Grade 29-4-2	S44800	70/55 [483/379]	Seamless & Welded Tube	29Cr-4Mo-2Ni

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys									
10K	1	ASTM	A 803	Grade 26-3-3	S44660	—	85/65 [586/448]	Welded Tube	26Cr-3Ni-3Mo
11A	1	ASTM	A 333	Grade 8	K81340	—	100/75 [689/517]	Seamless & Welded Pipe	9Ni
11A	1	ASTM	A 334	Grade 8	K81340	—	100/75 [689/517]	Tube	9Ni
11A	1	ASTM	A 353	—	K81340	—	100/75 [689/517]	Plate	9Ni
11A	1	ASTM	A 420	Grade WPL8	K81340	—	100/75 [689/517]	Pipe	9Ni
11A	1	ASTM	A 522	Type I	K81340	—	100/75 [689/517]	Forging	9Ni
11A	1	ASTM	A 522	Type II	K71340	—	100/75 [689/517]	Forging	8Ni
11A	1	ASTM	A 553	Type I	K81340	—	100/85 [689/586]	Plate	9Ni
11A	1	ASTM	A 553	Type II	K71340	—	100/85 [689/586]	Plate	8Ni
11A	1	ASTM	A 707	Grade L8, Class 1	K42247	—	60/42 [414/290]	Forging	3.35Ni-1.75Cr-0.5Mo-0.3Mn
11A	1	ASTM	A 844	Grade 9% Ni	K81340	≤2 [50]	100/85 [689/586]	Pressure Vessel Plate	9Ni-0.29Si
11A	2	ASTM	A 645	—	K41583	—	95/65 [655/448]	Plate	0.5Ni-0.25Mo
11A	2	ASTM	A 707	Grade L8, Class 2	K42247	—	66/52 [455/359]	Forging	3.35Ni-1.75Cr-0.5Mo-0.3Mn
11A	2	ASTM	A 734	Type A	K21205	—	77/65 [531/448]	Pressure Vessel Plate	C-Mn-1Ni-1Cr-0.3Mo
11A	3	ASTM	A 487	Grade 4, Class B	J13047	—	105/85 [724/586]	Castings	0.5Ni-0.5Cr-0.25Mo-V
11A	3	ASTM	A 487	Grade 4, Class E	J13047	—	115/95 [793/655]	Castings	0.5Ni-0.5Cr-0.25Mo-V
11A	3	ASTM	A 707	Grade L8, Class 3	K42247	—	75/60 [517/414]	Forging	3.35Ni-1.75Cr-0.5Mo-0.3Mn
11A	4	ASTM	A 533	Grade A, Class 3	K12521	—	100/83 [689/572]	Plate	Mn-0.5Mo
11A	4	ASTM	A 533	Grade B, Class 3	K12539	—	100/83 [689/572]	Plate	Mn-0.5Mo-0.5Ni
11A	4	ASTM	A 533	Grade C, Class 3	K12554	—	100/83 [689/572]	Plate	Mn-0.5Mo-0.75Ni
11A	4	ASTM	A 533	Grade D, Class 3	K12529	—	100/83 [689/572]	Plate	Mn-0.5Mo-0.3Ni
11A	4	ASTM	A 672	Grade J100	K12521	—	100/83 [689/572]	Fusion Welded Pipe	Mn-0.5Mo
11A	4	ASTM	A 707	Grade L8, Class 4	K42247	—	90/75 [621/517]	Forging	3.35Ni-1.75Cr-0.5Mo-0.3Mn
11A	5	ASTM	A 352	Grade LC2-1	J42215	—	105/80 [724/552]	Castings	3Ni-10.5Cr-0.5Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys									
11A	5	ASTM	A 508	Grade 4N, Class 1	K22375	—	105/85 [724/586]	Forging	30.5Ni-1.75Cr-0.5Mo-V
11A	5	ASTM	A 508	Grade 4N, Class 2	K22375	—	115/100 [793/689]	Forging	30.5Ni-1.75Cr-0.5Mo-V
11A	5	ASTM	A 508	Grade 5, Class 1	K42365	—	105/85 [724/586]	Forging	30.5Ni-1.75Cr-0.5Mo-V
11A	5	ASTM	A 508	Grade 5, Class 2	K42365	—	115/100 [793/689]	Forging	30.5Ni-1.75Cr-0.5Mo-V
11A	5	ASTM	A 543	Type B, Class 1	K42339	—	105/85 [724/586]	Plate	3Ni-1.75Cr-0.5Mo
11A	5	ASTM	A 543	Type B, Class 3	K42339	—	90/70 [621/483]	Plate	3Ni-1.75Cr-0.5Mo
11A	5	ASTM	A 543	Type C, Class 1	K42338	—	105/85 [724/586]	Plate	2.75Ni-1.75Cr-0.5Mo
11A	5	ASTM	A 543	Type C, Class 3	K42338	—	90/70 [621/483]	Plate	2.75Ni-1.75Cr-0.5Mo
11B	1	ASTM	A 514	Grade A	K11856	≤2.5 [64]	110/100 [758/689]	Plate	0.5Cr-0.25Mo-Si
11B	1	ASTM	A 514	Grade A	K11856	>2.5 ≤6.0 [64 ≤150]	100/90 [689/621]	Plate	0.5Cr-0.25Mo-Si
11B	1	ASTM	A 517	Grade A	K11856	≤2.5 [64]	115/100 [793/689]	Plate	0.5Cr-0.25Mo-Si
11B	1	ASTM	A 517	Grade A	K11856	>2.5 ≤6.0 [64 ≤150]	105/90 [724/621]	Plate	0.5Cr-0.25Mo-Si
11B	1	ASTM	A 592	Grade A	K11856	≤2.5 [64]	115/100 [793/689]	Forging	0.5Cr-0.25Mo-Si
11B	1	ASTM	A 592	Grade A	K11856	>2.5 ≤4.0 [64 ≤100]	105/90 [724/621]	Forging	0.5Cr-0.25Mo-Si
11B	1	ASTM	A 709	Grade 100, Type A	K11856	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	0.5Cr-0.25Mo-Si
11B	1	ASTM	A 709	Grade 100W, Type A	K11856	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	0.5Cr-0.25Mo-Si
11B	2	ASTM	A 514	Grade E	K21604	≤2.5 [64]	110/100 [758/689]	Plate	1.75Cr-0.5Mo-Cu
11B	2	ASTM	A 514	Grade E	K21604	>2.5 ≤6.0 [64 ≤150]	100/90 [689/621]	Plate	1.75Cr-0.5Mo-Cu
11B	2	ASTM	A 517	Grade E	K21604	≤2.5 [64]	115/100 [793/689]	Plate	1.75Cr-0.5Mo-Cu
11B	2	ASTM	A 517	Grade E	K21604	>2.5 ≤6.0 [64 ≤150]	105/90 [724/621]	Plate	1.75Cr-0.5Mo-Cu
11B	2	ASTM	A 592	Grade E	K11695	≤2.5 [64]	115/100 [793/689]	Forging	1.75Cr-0.5Mo-Cu
11B	2	ASTM	A 592	Grade E	K11695	>2.5 ≤3.75 [64 ≤95]	100/90 [689/621]	Forging	1.75Cr-0.5Mo-Cu
11B	2	ASTM	A 709	Grade 100, Type E	K21604	≤2.5	110/100 [758/689]	Plate & Shapes	1.75Cr-0.5Mo-Cu
11B	2	ASTM	A 709	Grade 100, Type E	K21604	>2.5 ≤4.0 [64 ≤100]	100/90 [689/621]	Plate & Shapes	1.75Cr-0.5Mo-Cu
11B	2	ASTM	A 709	Grade 100W, Type E	K21604	≤2.5	110/100 [758/689]	Plate & Shapes	1.75Cr-0.5Mo-Cu
11B	2	ASTM	A 709	Grade 100W, Type E	K21604	>2.5 ≤4.0 [64 ≤100]	100/90 [689/621]	Plate & Shapes	1.75Cr-0.5Mo-Cu

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
11B 3	ASTM	A 514	Grade F	K11576	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	0.75Ni-0.5Cr-0.5Mo-V
11B 3	ASTM	A 514	Grade F	K11576	>2.5 ≤6.0	100/90 [689/621]	Plate & Shapes	0.75Ni-0.5Cr-0.5Mo-V
11B 3	ASTM	A 514	Grade H	K21604	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	0.5Ni-0.5Cr-0.25Mo-V
11B 3	ASTM	A 514	Grade H	K21604	>2.5 ≤6.0	100/90 [689/621]	Plate & Shapes	0.5Ni-0.5Cr-0.25Mo-V
11B 3	ASTM	A 517	Grade F	K11576	≤2.5 [64]	115/100 [793/689]	Plate	0.75Ni-0.5Cr-0.5Mo-V
11B 3	ASTM	A 517	Grade H	K21604	≤2.0 [50]	115/100 [793/689]	Plate	0.5Ni-0.5Cr-0.25Mo-V
11B 3	ASTM	A 592	Grade F	K11576	≤2.5 [64]	115/100 [793/689]	Forging	0.75Ni-0.5Cr-0.5Mo-V
11B 3	ASTM	A 592	Grade F	K11576	>2.5 ≤4.0 [≥64 ≤100]	105/90 [724/621]	Forging	0.75Ni-0.5Cr-0.5Mo-V
11B 3	ASTM	A 709	Grade 100, Type F	K11576	≤2.5 [64]	110/100 [758/689]	Plates & Shapes	0.75Ni-0.5Cr-0.5Mo-V
11B 3	ASTM	A 709	Grade 100W, Type F	K11576	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	0.75Ni-0.5Cr-0.5Mo-V
11B 3	ASTM	A 709	Grade 100, Type H	K21504	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	0.5Ni-0.5Cr-0.25Mo-V
11B 3	ASTM	A 709	Grade 100W, Type H	K21504	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	0.5Ni-0.5Cr-0.25Mo-V
11B 4	ASTM	A 514	Grade B	K11630	≤2.5 [64]	110/100 [758/689]	Plate	0.5Cr-0.2Mo-V
11B 4	ASTM	A 514	Grade B	K11630	>2.5 ≤6.0 [≥64 ≤150]	100/90 [689/621]	Plate	0.5Cr-0.2Mo-V
11B 4	ASTM	A 517	Grade B	K11630	≤1.25 [32]	115/100 [793/689]	Plate	0.5Cr-0.2Mo-V
11B 4	ASTM	A 709	Grade 100, Type B	K11630	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	0.5Cr-0.2Mo-V
11B 4	ASTM	A 709	Grade 100W, Type B	K11630	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	0.5Cr-0.2Mo-V
11B 4	ASTM	A 782	Class 1	—	—	97/80 [669/552]	Pressure Vessel Plate	0.96Mn-0.76Cr-0.6 Si-0.4Mo-0.09Zr
11B 4	ASTM	A 782	Class 2	—	—	107/90 [738/621]	Pressure Vessel Plate	0.96Mn-0.76Cr-0.6 Si-0.4Mo-0.09Zr
11B 4	ASTM	A 782	Class 3	—	—	115/100 [793/689]	Pressure Vessel Plate	0.96Mn-0.76Cr-0.6 Si-0.4Mo-0.09Zr
11B 6	ASTM	A 514	Grade C	K11511	≤2.5 [64]	110/100 [758/689]	Plate	1.2Mn-0.2Mo
11B 6	ASTM	A 514	Grade C	K11511	>2.5 ≤6.0 [≥64 ≤150]	100/90 [689/621]	Plate	1.2Mn-0.2Mo
11B 6	ASTM	A 514	Grade J	K11625	≤2.5 [64]	110/100 [758/689]	Plate	C-0.5Mo
11B 6	ASTM	A 514	Grade J	K11625	>2.5 ≤6.0 [≥64 ≤150]	100/90 [689/621]	Plate	C-0.5Mo
11B 6	ASTM	A 514	Grade K	K11523	≤2.5 [64]	110/100 [758/689]	Plate	Mn-Mo-B

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
11B 6	ASTM	A 514	Grade K	K11523	>2.5 ≤6.0 [64 ≤150]	100/90 [689/621]	Plate	Mn-Mo-B
11B 6	ASTM	A 514	Grade S	—	≤2.5 [64]	110/100 [758/689]	Plate	Mn-Mo-B
11B 6	ASTM	A 514	Grade S	—	>2.5 ≤6.0 [64 ≤150]	100/90 [689/621]	Plate	Mn-Mo-B
11B 6	ASTM	A 514	Grade T	—	≤2.5 [64]	110/100 [758/689]	Plate	Mn-Mo-B
11B 6	ASTM	A 514	Grade T	—	>2.5 ≤6.0 [64 ≤150]	100/90 [689/621]	Plate	Mn-Mo-B
11B 6	ASTM	A 517	Grade J	K11625	≤1.25 [32]	115/100 [793/689]	Plate	C-0.5Mo
11B 6	ASTM	A 517	Grade K	K11523	≤2.0 [50]	115/100 [793/689]	Plate	Mn-Mo-B
11B 6	ASTM	A 517	Grade S	—	≤2.0 [50]	115/100 [793/689]	Plate	Mn-Mo-B
11B 6	ASTM	A 517	Grade T	—	≤2.0 [50]	115/100 [793/689]	Plate	Mn-Mo-B
11B 6	ASTM	A 709	Grade 100, Type C	K11511	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	1.2Mn-0.2Mo
11B 6	ASTM	A 709	Grade 100W, Type C	K11511	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	1.2Mn-0.2Mo
11B 6	ASTM	A 709	Grade 100, Type J	K11625	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	C-0.5Mo
11B 6	ASTM	A 709	Grade 100W, Type J	K11625	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	C-0.5Mo
11B 8	ASTM	A 514	Grade P	K21650	≤2.5 [64]	110/100 [758/689]	Plate	1.25Ni-1Cr-0.5Mo
11B 8	ASTM	A 514	Grade P	K21650	>2.5 ≤6.0 [64 ≤150]	100/90 [689/621]	Plate	1.25Ni-1Cr-0.5Mo
11B 8	ASTM	A 517	Grade P	K21650	≤2.5 [64]	115/100 [793/689]	Plate	1.25Ni-1Cr-0.5Mo
11B 8	ASTM	A 517	Grade P	K21650	>2.5 ≤4.0 [64 ≤100]	105/90 [724/621]	Plate	1.25Ni-1Cr-0.5Mo
11B 8	ASTM	A 709	Grade 100, Type P	K21650	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	1.25Ni-1Cr-0.5Mo
11B 8	ASTM	A 709	Grade 100, Type P	K21650	>2.5 ≤4.0 [64 ≤100]	100/90 [689/621]	Plates & Shapes	1.25Ni-1Cr-0.5Mo
11B 8	ASTM	A 709	Grade 100W, Type P	K21650	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	1.25Ni-1Cr-0.5Mo
11B 8	ASTM	A 709	Grade 100W, Type P	K21650	>2.5 ≤4.0 [64 ≤100]	100/90 [689/621]	Plates & Shapes	1.25Ni-1Cr-0.5Mo
11B 9	ASTM	A 514	Grade Q	—	≤2.5 [64]	110/100 [758/689]	Plate	1.3Ni-1.3Cr-0.5Mo-V
11B 9	ASTM	A 514	Grade Q	—	>2.5 ≤6.0 [64 ≤150]	100/90 [689/621]	Plate	1.3Ni-1.3Cr-0.5Mo-V
11B 9	ASTM	A 517	Grade Q	—	≤2.5 [64]	115/100 [793/689]	Plate	1.3Ni-1.3Cr-0.5Mo-V
11B 9	ASTM	A 517	Grade Q	—	>2.5 ≤6.0 [64 ≤150]	105/90 [724/621]	Plate	1.3Ni-1.3Cr-0.5Mo-V
11B 9	ASTM	A 519	Grade 4130	G41300	—	75/55 [517/379]	Mechanical Tube	1Cr-0.2Mo
11B 9	ASTM	A 519	Grade 8630	G86300	—	75/55 [517/379]	Mechanical Tube	0.5Ni-0.5Cr-0.2Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Ferrous Alloys

Material Group Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Steel and Steel Alloys								
11B 9	ASTM	A 709	Grade 100, Type Q	—	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	1.3Ni-1.3Cr-0.5Mo
11B 9	ASTM	A 709	Grade 100, Type Q	—	>2.5 ≤4 [≥64 ≤100]	100/90 [689/621]	Plate & Shapes	1.3Ni-1.3Cr-0.5Mo
11B 9	ASTM	A 709	Grade 100W, Type Q	—	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	1.3Ni-1.3Cr-0.5Mo
11B 9	ASTM	A 709	Grade 100W, Type Q	—	>2.5 ≤4.0 [≥64 ≤100]	100/90 [689/621]	Plate & Shapes	1.3Ni-1.3Cr-0.5Mo
11B 10	ASTM	A 514	Grade M	K11683	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	1.3Ni-0.5Mo
11B 10	ASTM	A 514	Grade M	K11683	>2.5 ≤6.0 [≥64 ≤150]	100/90 [689/621]	Plate & Shapes	1.3Ni-0.5Mo
11B 10	ASTM	A 517	Grade M	K11683	≤2.0 [50]	115/100 [793/689]	Plate & Shapes	1.3Ni-0.5Mo
11B 10	ASTM	A 543	Type B, Class 2	K42339	—	115/100 [793/689]	Plate	3Ni-1.75Cr-0.5Mo
11B 10	ASTM	A 543	Type C, Class 2	K42338	—	115/100 [793/689]	Plate	2.75Ni-1.75Cr-0.5Mo
11B 10	ASTM	A 709	Grade 100, Type M	K11683	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	1.3Ni-0.5Mo
11B 10	ASTM	A 709	Grade 100W, Type M	K11683	≤2.5 [64]	110/100 [758/689]	Plate & Shapes	1.3Ni-0.5Mo
11B 11	ASTM	A 709	Grade HPS70W	—	—	85/70 [586/483]	Plate & Shapes	C-Mn-Ni-Cu-Cr-V
11B 11	ASTM	A 852	Grade 70W	K12043	—	90/70 [621/483]	Plate & Shapes	C-Mn-Ni-Cu-Cr-V
11B 12	ASTM	A 514	Grade R	—	≤2.5 [64]	110/100 [758/689]	Plate	C-Mn-Ni-Cu-V
11B 12	ASTM	A 514	Grade R	—	>2.5 ≤6.0 [≥64 ≤150]	100/90 [689/621]	Plate	C-Mn-Ni-Cu-V
12A 1	ASTM	A 710	Grade A, Class 2	K20747	≤2.5 [64]	72/65 [496/448]	Structural	Ni-Cu-Cr-Mo-Cb
12A 1	ASTM	A 710	Grade A, Class 2	K20747	>2.5 ≤6.0 [≥64 ≤150]	100/90 [689/621]	Structural	Ni-Cu-Cr-Mo-Cb
12A 1	ASTM	A 710	Grade A, Class 2	K20747	<2.00 ≤4.0 <50 ≤100]	65/55 [448/379]	Structural	Ni-Cu-Cr-Mo-Cb
12A 1	ASTM	A 710	Grade A, Class 2	K20747	>4.0 [100]	60/50 [414/345]	Structural	Ni-Cu-Cr-Mo-Cb
12B 1	ASTM	A 710	Grade A, Class 3	K20747	≤1.25 [32]	85/80 [586/552]	Structural	Ni-Cu-Cr-Mo-Cb
12B 1	ASTM	A 710	Grade A, Class 3	K20747	>1.25 ≤2.0 [≥32 ≤50]	85/75 [586/517]	Structural	Ni-Cu-Cr-Mo-Cb
12B 1	ASTM	A 710	Grade A, Class 3	K20747	>2.0 ≤4.0 [≥50 ≤100]	75/65 [517/448]	Structural	Ni-Cu-Cr-Mo-Cb
12B 1	ASTM	A 710	Grade A, Class 3	K20747	>4.0 [100]	70/60 [483/414]	Structural	Ni-Cu-Cr-Mo-Cb
12C 1	ASTM	A 710	Grade A, Class 1	K20747	≤5/16 [8]	90/85 [621/586]	Structural	Ni-Cu-Cr-Mo-Cb
12C 1	ASTM	A 710	Grade A, Class 1	K20747	>5/16 ≤3/4 [≥8 ≤19]	90/80 [621/552]	Structural	Ni-Cu-Cr-Mo-Cb

Table D.2
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Aluminum and Aluminum Base Alloys								
21	ASTM	B 209	1060	A91060	—	8/2.5 [55/17]	Plate & Sheet	99.6minAl
21	ASTM	B 209	1100	A91100	—	11/3.5 [76/24]	Plate & Sheet	99.0minAl
21	ASTM	B 209	3003	A93003	—	14/5.0 [97/34]	Plate & Sheet	1.2Mn
21	ASTM	B 209	Alclad 3003	A83003	0.006–0.499 [0.15–12.5]	13/4.5 [90/31]	Plate & Sheet	1.2Mn
21	ASTM	B 209	Alclad 3003	A83003	0.500–3.000 [13–75]	14/5.0 [97/34]	Plate & Sheet	1.2Mn
21	ASTM	B 209	3005	A93005	—	17/6.5 [117/45]	Sheet	1.2Mn-0.4Mg
21	ASTM	B 209	3105	A93105	—	14/5.0 [97/34]	Sheet	0.5Mn-0.5Mg
21	ASTM	B 209	5005	A95005	—	15/5.0 [103/34]	Plate & Sheet	1.5Mg
21	ASTM	B 209	5010	A95010	—	15/5.0 [103/34]	Sheet	0.4Mg-0.2Mn
21	ASTM	B 209	5050	A95050	—	18/6.0 [124/41]	Plate & Sheet	Al-1.5Mg
21	ASTM	B 209	5457	A95457	—	16/— [110/—]	Sheet	1Mg-0.3Mn
21	ASTM	B 210	1060	A91060	—	8.5/2.5 [59/17]	Drawn Seamless Tube	99.6minAl
21	ASTM	B 210	1100	A91100	—	11/3.5 [76/24]	Drawn Seamless Tube	99.0minAl
21	ASTM	B 210	3003	A93003	—	14/5.0 [97/34]	Drawn Seamless Tube	1.2Mn
21	ASTM	B 210	Alclad 3003	A83003	—	13/4.5 [90/31]	Drawn Seamless Tube	1.2Mn
21	ASTM	B 210	3303	A93303	—	14/5.0 [97/34]	Drawn Seamless Tube	1.2Mn
21	ASTM	B 210	3102	A93102	—	11/3.5 [76/24]	Drawn Seamless Tube	0.25Mn
21	ASTM	B 210	Alclad 3102	A83102	—	10/3.5 [69/24]	Drawn Seamless Tube	0.25Mn
21	ASTM	B 210	Alclad 3303	A83303	—	13/4.5 [90/31]	Drawn Seamless Tube	1.2Mn
21	ASTM	B 210	5005	A95005	—	15/5.0 [103/34]	Drawn Seamless Tube	1.5Mg
21	ASTM	B 210	5050	A95050	—	18/6.0 [124/41]	Drawn Seamless Tube	Al-1.5Mg
21	ASTM	B 211	1060	A91060	—	8/2.5 [55/17]	Bar, Rod & Wire (Cold Finished)	99.6minAl
21	ASTM	B 211	1100	A91100	—	11/3.0 [76/21]	Bar, Rod & Wire (Cold Finished)	99.0minAl
21	ASTM	B 211	3003	A93003	—	14/5.0 [97/34]	Bar, Rod & Wire	1.2Mn
21	ASTM	B 221	1060	A91060	—	8.5/2.5 [59/17]	Ext. Bar, Rod, Wire, Shapes & Tube	99.6minAl
21	ASTM	B 221	1100	A91100	—	11/3.0 [76/21]	Ext. Bar, Rod, Wire, Shapes & Tube	99.0minAl

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Aluminum and Aluminum Base Alloys								
21	ASTM	B 221	3003	A93003	—	14/5.0 [97/34]	Ext. Bar, Rod, Wire, Shapes & Tube	1.2Mn
21	ASTM	B 221	Alclad 3003	A83003	—	13/4.5 [90/31]	Ext. Bar, Rod, Wire, Shapes & Tube	1.2Mn
21	ASTM	B 221	3102	A93102	—	11/4.0 [76/28]	Ext. Bar, Rod, Wire, Shapes & Tube	0.25Mn
21	ASTM	B 230	1350	A91350	—	8/— [55/—]	Wire (Electrical)	99.5minAl
21	ASTM	B 234	1060	A91060	—	8/2.5 [55/17]	Drawn Seamless Tube	99.6minAl
21	ASTM	B 234	3003	A93003	—	14/5.0 [97/34]	Drawn Seamless Tube	1.2Mn
21	ASTM	B 234	Alclad 3003	A83003	—	13/4.5 [90/31]	Drawn Seamless Tube	1.2Mn
21	ASTM	B 236	1350	A91350	—	8/— [55/—]	Bars (Electrical)	99.5minAl
21	ASTM	B 241	1060	A91060	—	8.5/2.5 [59/17]	Seamless Pipe & Ext. Tube	99.6minAl
21	ASTM	B 241	1100	A91100	—	11/3.0 [76/21]	Seamless Pipe & Ext. Tube	99.0minAl
21	ASTM	B 241	3003	A93003	—	14/5.0 [97/34]	Seamless Pipe & Ext. Tube	1.2Mn
21	ASTM	B 241	Alclad 3003	A83003	—	13/4.5 [90/31]	Seamless Pipe & Ext. Tube	1.2Mn
21	ASTM	B 247	1100	A91100	—	11/3.0 [76/21]	Die, H& & Rolled Ring Forgings	99.0minAl
21	ASTM	B 247	3003	A93003	—	14/5.0 [97/34]	Die, H& & Rolled Ring Forgings	1.2Mn
21	ASTM	B 313	1100	A91100	—	11/3.0 [76/21]	Welded Tube	99.0minAl
21	ASTM	B 313	3003	A93003	—	14/5.0 [97/34]	Welded Tube	1.2Mn
21	ASTM	B 313	3005	A93005	—	17/6.5 [117/45]	Welded Tube	1.2Mn-0.4Mg
21	ASTM	B 313	5050	A95050	—	18/6.0 [124/41]	Welded Tube	1.5Mg
21	ASTM	B 324	1350	A91350	—	8.5/— [59/—]	Rectangular & Square Wire (Electrical)	99.5minAl
21	ASTM	B 345	1060	A91060	—	8.5/2.5 [59/17]	Seamless Pipe & Tube (Gas & Oil Trans.)	99.6minAl
21	ASTM	B 345	3003	A93003	—	14/5.0 [97/34]	Seamless Pipe & Tube (Gas & Oil Trans.)	1.2Mn
21	ASTM	B 345	Alclad 3003	A83003	—	13/4.5 [90/31]	Seamless Pipe & Tube (Gas & Oil Trans.)	1.2Mn
21	ASTM	B 361	WP1060	A91060	—	8/— [55/—]	Fittings	99.6minAl
21	ASTM	B 361	WP1100	A91100	—	11/3.5 [76/24]	Fittings	99.0Al-Si
21	ASTM	B 361	WP3003	A93003	—	14/5.0 [97/34]	Fittings	Al-Mg-1Cu-1.2Mn
21	ASTM	B 361	Alclad 3003	A83003	—	13/4.5 [90/31]	Fittings	1.2Mn

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Aluminum and Aluminum Base Alloys								
21	ASTM	B 396	5005	A95005	—	15/5.0 [103/34]	Wire (Electrical)	0.8Mg
21	ASTM	B 483	1060	A91060	—	8.5/2.5 [59/17]	Drawn Tube (Gen. Purpose)	99.6minAl
21	ASTM	B 483	1100	A91100	—	11/3.5 [76/24]	Drawn Tube (Gen. Purpose)	99.0minAl
21	ASTM	B 483	1435	A91435	—	9.5/3.0 [66/21]	Drawn Tube (Gen. Purpose)	99.35minAl-0.4Fe
21	ASTM	B 483	3003	A93003	—	14/5.0 [97/34]	Drawn Tube (Gen. Purpose)	1.2Mn
21	ASTM	B 483	3102	A93102	—	11/3.5 [76/24]	Drawn Tube (Gen. Purpose)	0.25Mn
21	ASTM	B 483	5005	A95005	—	15/5.0 [103/34]	Drawn Tube (Gen. Purpose)	0.8Mg
21	ASTM	B 483	5050	A95050	—	18/6.0 [124/41]	Drawn Tube (Gen. Purpose)	1.5Mg
21	ASTM	B 491	1050	A91050	—	8/2.5 [55/17]	Extruded Tube (Gen. Purpose)	99.5minAl
21	ASTM	B 491	1100	A91100	—	11/3.5 [76/24]	Extruded Tube (Gen. Purpose)	99.0minAl
21	ASTM	B 491	1200	A91200	—	11/3.5 [76/24]	Extruded Tube (Gen. Purpose)	99.0minAl
21	ASTM	B 491	1235	A91235	—	9.5/3.0 [66/21]	Extruded Tube (Gen. Purpose)	99.35minAl
21	ASTM	B 491	3003	A93003	—	14/5.0 [97/34]	Extruded Tube (Gen. Purpose)	1.2Mn
21	ASTM	B 491	3102	A93102	—	11/3.5 [76/24]	Extruded Tube (Gen. Purpose)	0.25Mn
21	ASTM	B 547	1100	A91100	—	11/3.5 [76/24]	Roll Formed & Long. Welded Tube	99.0minAl
21	ASTM	B 547	3003	A93003	—	14/5.0 [97/34]	Roll Formed & Long. Welded Tube	1.2Mn
21	ASTM	B 547	Alclad 3003	A83003	—	13/4.5 [90/31]	Roll Formed & Long. Welded Tube	1.2Mn
21	ASTM	B 547	5050	A95050	—	18/6.0 [124/41]	Roll Formed & Long. Welded Tube	1.5Mg
21	ASTM	B 609	1350	A91350	—	8.5/— [59/—]	Wire (Electrical)	99.5minAl
22	ASTM	B 209	3004	A93004	—	22/8.5 [152/59]	Plate & Sheet	1.2Mn-1.0Mg
22	ASTM	B 209	Alclad 3004	A83004	0.006–0.499 [0.15–12.5]	21/8.0 [145/55]	Plate & Sheet	1.2Mn-1.0Mg
22	ASTM	B 209	Alclad 3004	A83004	0.500–3.000 [13–75]	22/8.5 [152/59]	Plate & Sheet	1.2Mn-1.0Mg
22	ASTM	B 209	5052	A95052	—	25/9.5 [172/66]	Plate & Sheet	2.5Mg-0.25Cr
22	ASTM	B 209	5154	A95154	—	30/11 [207/76]	Plate & Sheet	3.5Mg-0.25Cr
22	ASTM	B 209	5252	A95252	—	25/9.5 [172/66]	Plate & Sheet	2.5Mg-0.25Cr
22	ASTM	B 209	5254	A95254	—	30/11 [207/76]	Plate & Sheet	3.5Mg-0.25Cr

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Aluminum and Aluminum Base Alloys								
22	ASTM	B 209	5454	A95454	—	31/12 [214/83]	Plate & Sheet	2.75Mg-0.8Mn-0.1Cr
22	ASTM	B 209	5652	A95652	—	25/9.5 [172/66]	Plate & Sheet	2.5Mg-0.25Cr-0.01maxMn
22	ASTM	B 210	5052	A95052	—	25/9.5 [172/66]	Drawn Seamless Tube	2.5Mg-0.25Cr
22	ASTM	B 210	5154	A95154	—	30/11 [207/76]	Drawn Seamless Tube	3.5Mg-0.25Cr
22	ASTM	B 211	5052	A95052	0.125 [3]	25/9.5 [172/66]	Bar, Rod & Wire (Cold Finished)	2.5Mg-0.25Cr
22	ASTM	B 211	5154	A95154	—	30/11 [207/76]	Bar, Rod & Wire (Cold Finished)	3.5Mg-0.25Cr
22	ASTM	B 221	3004	A93004	—	23/8.5 [159/59]	Ext. Bar, Rod, Wire, Shapes & Tube	1.2Mn-1.0Mg
22	ASTM	B 221	5052	A95052	—	25/10 [172/69]	Ext. Bar, Rod, Wire, Shapes & Tube	2.5Mg-0.25Cr
22	ASTM	B 221	5154	A95154	—	30/11 [207/76]	Ext. Bar, Rod, Wire, Shapes & Tube	3.5Mg-0.25Cr
22	ASTM	B 221	5454	A95454	—	31/12 [214/83]	Ext. Bar, Rod, Wire, Shapes & Tube	2.75Mg-0.8Mn-0.1Cr
22	ASTM	B 234	5052	A95052	—	25/9.5 [172/66]	Drawn Seamless Tubes	2.5Mg-0.25Cr
22	ASTM	B 234	5454	A95454	—	31/12 [214/83]	Drawn Seamless Tubes	2.75Mg-0.8Mn-0.1Cr
22	ASTM	B 241	5052	A95052	—	25/10 [172/69]	Extruded Seamless Pipe & Tube	2.5Mg-0.25Cr
22	ASTM	B 241	5454	A95454	—	31/12 [214/83]	Extruded Seamless Pipe & Tube	2.75Mg-0.8Mn-0.1Cr
22	ASTM	B 313	3004	A93004	—	22/8.5 [152/59]	Formed Sheet & Seam Welded Tube	1.2Mn-1.0Mg
22	ASTM	B 313	Alclad 3004	A83004	—	21/8.0 [145/55]	Formed Sheet & Seam Welded Tube	1.2Mn-1.0Mg
22	ASTM	B 313	5052	A95052	—	25/9.5 [172/66]	Formed Sheet & Seam Welded Tube	2.5Mg-0.25Cr
22	ASTM	B 313	5154	A95154	—	30/11 [207/76]	Formed Sheet & Seam Welded Tube	3.5Mg-0.25Cr
22	ASTM	B 361	WP5154	A95154	—	30/— [207/—]	Fittings	3.5Mg-0.25Cr
22	ASTM	B 483	5052	A95052	—	25/9.5 [172/66]	Drawn Tube (Gen. Purpose)	2.5Mg-0.25Cr
22	ASTM	B 547	3004	A93004	—	22/8.5 [152/59]	Formed Sheet & Arc Welded Tube	1.2Mn-1.0Mg
22	ASTM	B 547	Alclad 3004	A83004	—	21/8.0 [145/55]	Formed Sheet & Arc Welded Tube	1.2Mn-1.0Mg
22	ASTM	B 547	5052	A95052	—	25/9.5 [172/66]	Formed Sheet & Arc Welded Tube	2.5Mg-0.25Cr
22	ASTM	B 547	5154	A95154	—	30/11 [207/76]	Formed Sheet & Arc Welded Tube	3.5Mg-0.25Cr
22	ASTM	B 547	5454	A95454	—	31/12 [214/83]	Formed Sheet & Arc Welded Tube	2.75Mg-0.8Mn-0.1Cr
23	ASTM	B 209	6061 (T4, T6, T651)	A96061	—	24/— [165/—]	Plate & Sheet	1Mg-0.6Si-0.25Cr

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Aluminum and Aluminum Base Alloys								
23	ASTM	B 209	Alclad 6061 (T4, T6, T62, T651)	A86061	0.051–0.499 [1.3–12.5]	23/– [159/–]	Plate & Sheet	1Mg-0.6Si-0.25Cr
23	ASTM	B 209	Alclad 6061 (T4, T6, T62, T651)	A86061	0.500–5.000 [13–125]	24/– [165/–]	Plate & Sheet	1Mg-0.6Si-0.25Cr
23	ASTM	B 210	6061 (T4, T6)	A96061	—	24/– [165/–]	Drawn Seamless Tube	1Mg-0.6Si-0.25Cr
23	ASTM	B 210	6063 (T4, T6, T62, T83)	A96063	—	17/– [117/–]	Drawn Seamless Tube	0.7Mg-0.4Si
23	ASTM	B 211	6061 (T4, T6, T62, T651)	A96061	—	24/– [165/–]	Bar, Rod & Wire	1Mg-0.6Si-0.25Cr
23	ASTM	B 221	6005 (T1, T5)	A96005	—	24/– [165/–]	Ext. Rod, Bar, Shapes & Tube	0.75Si-0.5Mg
23	ASTM	B 221	6005A (T1, T5)	A96005	—	24/– [165/–]	Ext. Rod, Bar, Shapes & Tube	0.7Si-0.55Mg-0.3(Mn-Cr)
23	ASTM	B 221	6061 (T1, T4, T5, T6, T651)	A96061	—	24/– [165/–]	Ext. Rod, Bar, Shapes & Tube	1Mg-0.6Si-0.25Cr
23	ASTM	B 221	6063 (T1, T4, T5, T6)	A96063	—	17/– [117/–]	Ext. Rod, Bar, Shapes & Tube	0.7Mg-0.4Si
23	ASTM	B 221	6105 (T1, T5)	A96105	—	24/– [165/–]	Ext. Rod, Bar, Shapes & Tube	0.8Si-0.6Mg
23	ASTM	B 221	6162 (T5, T55, T6, T65)	A96162	—	24/– [165/–]	Ext. Rod, Bar, Shapes & Tube	0.9Mg-0.6Si
23	ASTM	B 221	6351 (T1, T4, T5, T6)	A96351	—	24/– [165/–]	Ext. Rod, Bar, Shapes & Tube	1Si-0.6Mg-0.6Mn
23	ASTM	B 221	6463 (T1, T5, T6)	A96463	—	17/– [117/–]	Ext. Rod, Bar, Shapes & Tube	0.7Mg-0.4Si
23	ASTM	B 234	6061 (T4, T6)	A96061	—	24/– [165/–]	Drawn Seamless Tube	1Mg-0.6Si-0.25Cr
23	ASTM	B 241	6061 (T1, T4, T42, T51, T6, T62)	A96061	—	24/– [165/–]	Extruded Seamless Pipe & Tube	1Mg-0.6Si-0.25Cr
23	ASTM	B 241	6063 (T1, T4, T42, T5, T52, T6, T62)	A96063	—	17/– [117/–]	Extruded Seamless Pipe & Tube	0.7Mg-0.4Si
23	ASTM	B 241	6162 (T5, T55, T6, T65)	A96162	—	24/– [165/–]	Extruded Seamless Pipe & Tube	0.9Mg-0.6Si
23	ASTM	B 241	6351 (T4, T6)	A96351	—	24/– [165/–]	Extruded Seamless Pipe & Tube	1Si-0.6Mg-0.6Mn
23	ASTM	B 247	6061 (T6)	A96061	—	24/– [165/–]	Die Forgings	1Mg-0.6Si-0.25Cr

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Aluminum and Aluminum Base Alloys								
23	ASTM	B 247	6061 (T6, T652)	A96061	—	24/— [165/—]	Rolled Ring Forgings	1Mg-0.6Si-0.25Cr
23	ASTM	B 247	6061 (T6, T652)	A96061	—	24/— [165/—]	H& Forgings	1Mg-0.6Si-0.25Cr
23	ASTM	B 247	6151 (T6)	A96151	—	24/— [165/—]	Die Forgings	0.8Si-0.7Mg-0.25Cr
23	ASTM	B 247	6151 (T6, T652)	A96151	—	24/— [165/—]	Rolled Ring Forgings	0.8Si-0.7Mg-0.25Cr
23	ASTM	B 308	6061 (T6)	A96061	—	24/— [165/—]	Standard Structural Shapes	1Mg-0.6Si-0.25Cr
23	ASTM	B 313	6061 (T4, T6)	A96061	—	24/— [165/—]	Formed Sheet & Seam Welded Tube	1Mg-0.6Si-0.25Cr
23	ASTM	B 317	6101 (T6, T61, T64, T65)	A96101	—	11/— [76/—]	Ext. Bar, Rod, Wire, Shapes & Tube	0.55Mg-0.5Si
23	ASTM	B 345	6061 (T4, T45, T6, T65)	A96061	—	24/— [165/—]	Extruded Seamless Pipe & Tube	1Mg-0.6Si-0.25Cr
23	ASTM	B 345	6063 (T1, T4, T5, T6)	A96063	—	17/— [117/—]	Extruded Seamless Pipe & Tube	0.7Mg-0.4Si
23	ASTM	B 345	6351 (T4, T6)	A96351	—	24/— [165/—]	Extruded Seamless Pipe & Tube	1Si-0.6Mg-0.6Mn
23	ASTM	B 429	6061 (T6)	A96061	—	24/— [165/—]	Extruded Seamless Pipe & Tube	1Mg-0.6Si-0.25Cr
23	ASTM	B 429	6063 (T6)	A96063	—	17/— [117/—]	Extruded Seamless Pipe & Tube	0.7Mg-0.4Si
23	ASTM	B 483	6061 (T4, T6)	A96061	—	24/— [165/—]	Drawn Tube (Gen. Purpose)	1Mg-0.6Si-0.25Cr
23	ASTM	B 483	6063 (T4, T6)	A96063	—	17/— [117/—]	Drawn Tube (Gen. Purpose)	0.7Mg-0.4Si
23	ASTM	B 491	6063 (T1)	A96063	—	17/— [117/—]	Drawn Tube (Gen. Purpose)	0.7Mg-0.4Si
23	ASTM	B 547	6061 (T4, T6)	A96061	—	24/— [165/—]	Formed & Arc Seam Welded Tube	1Mg-0.6Si-0.25Cr
23	ASTM	B 632	6061 (T4, T6)	A96061	—	24/— [165/—]	Tread Plate	1Mg-0.6Si-0.25Cr
23	ISO	209	6082 (T4, T6)	A96082	—	24/— [165/—]	Ext. Rod, Bar, Shapes & Tube	1Si-0.8Mg-0.7Mn
24	ASTM	B 209	2014 (T3, T4, T45, T6, T65)	A92014	—	35/— [241/—]	Plate & Sheet	4.45Cu-0.85Si-0.8Mn-0.6Mg
24	ASTM	B 209	Alclad 2014 (T3, T4, T45, T6, T65)	A82014	—	35/— [241/—]	Plate & Sheet	4.45Cu-0.85Si-0.8Mn-0.6Mg
24	ASTM	B 209	2219 (T31, T37, T62, T81, T87)	A92219	—	35/— [241/—]	Plate & Sheet	6.3Cu-0.3Mn-0.06Ti-0.17Zr

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Aluminum and Aluminum Base Alloys								
24	ASTM	B 209	Alclad 2219 (T31, T37, T62, T81, T87)	A82219	—	35/— [241/—]	Plate & Sheet	6.3Cu-0.3Mn-0.06Ti-0.17Zr
24	ASTM	B 210	2014 (T4, T6)	A92014	—	35/— [241/—]	Drawn Seamless Tube Bar, Rod & Wire Bar, Rod & Wire Ext. Bar, Rod, Wire, Shapes & Tube	4.45Cu-0.85Si-0.8Mn-0.6Mg
24	ASTM	B 211	2014 (T4, T6)	A92014	—	35/— [241/—]		4.45Cu-0.85Si-0.8Mn-0.6Mg
24	ASTM	B 211	2219 (T851)	A92219	—	35/— [241/—]		6.3Cu-0.3Mn-0.06Ti-0.17Zr
24	ASTM	B 221	2014 (T4, T45, T6, T65)	A92014	—	35/— [241/—]		4.45Cu-0.85Si-0.8Mn-0.6Mg
24	ASTM	B 221	2219 (T31, T35, T62, T81, T85)	A92219	—	35/— [241/—]	Ext. Bar, Rod, Wire, Shapes & Tube	6.3Cu-0.3Mn-0.06Ti-0.17Zr
24	ASTM	B 241	2014 (T4, T45, T6, T62, T65)	A92014	—	35/— [241/—]	Extruded Seamless Pipe & Tube	4.45Cu-0.85Si-0.8Mn-0.6Mg
24	ASTM	B 241	2219 (T31, T35, T62, T81, T85)	A92219	—	35/— [241/—]	Extruded Seamless Pipe & Tube	6.3Cu-0.3Mn-0.06Ti-0.17Zr
24	ASTM	B 247	2014 (T4, T6)	A92014	—	35/— [241/—]	Die Forgings H& Forgings Die Forgings H& Forgings	4.45Cu-0.85Si-0.8Mn-0.6Mg
24	ASTM	B 247	2014 (T6, T652)	A92014	—	35/— [241/—]		4.45Cu-0.85Si-0.8Mn-0.6Mg
24	ASTM	B 247	2219 (T6)	A92219	—	35/— [241/—]		6.3Cu-0.3Mn-0.06Ti-0.17Zr
24	ASTM	B 247	2219 (T6, T852)	A92219	—	35/— [241/—]		6.3Cu-0.3Mn-0.06Ti-0.17Zr
25	ASTM	B 209	5083	A95083	0.051–1.500 [1.25–38]	40/18 [276/124]	Plate & Sheet	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 209	5083	A95083	1.501–3.000 [38–75]	39/17 [269/117]	Plate	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 209	5083	A95083	3.001–5.000 [80–125]	38/16 [262/110]	Plate	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 209	5083	A95083	5.001–7.000 [125–175]	37/15 [255/103]	Plate	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 209	5083	A95083	7.001–8.000 [175–200]	36/14 [248/97]	Plate	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 209	5086	A95086	0.020–2.000 [0.50–50]	35/14 [241/97]	Plate & Sheet	4.0Mg-0.5Mn-0.15Cr

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Aluminum and Aluminum Base Alloys								
25	ASTM	B 209	5086	A95086	2.001–3.000 [50–76]	34/14 [234/97]	Plate	4.0Mg-0.5Mn-0.15Cr
25	ASTM	B 209	5456	A95456	0.051–1.500 [1.25–38]	42/19 [290/131]	Plate & Sheet	5.1Mg-0.8Mn-0.1Cr
25	ASTM	B 209	5456	A95456	1.501–3.000 [38–76]	41/18 [283/124]	Plate	5.1Mg-0.8Mn-0.1Cr
25	ASTM	B 209	5456	A95456	3.001–5.000 [80–125]	40/17 [276/117]	Plate	5.1Mg-0.8Mn-0.1Cr
25	ASTM	B 209	5456	A95456	5.001–7.000 [125–175]	39/16 [269/110]	Plate	5.1Mg-0.8Mn-0.1Cr
25	ASTM	B 209	5456	A95456	7.001–8.000 [175–200]	38/15 [262/103]	Plate	5.1Mg-0.8Mn-0.1Cr
25	ASTM	B 210	5083	A95083	—	39/16 [269/110]	Drawn Seamless Tube	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 210	5086	A95086	—	35/14 [241/97]	Drawn Seamless Tube	4.0Mg-0.5Mn-0.15Cr
25	ASTM	B 210	5456	A95456	—	41/19 [283/131]	Drawn Seamless Tube	5.1Mg-0.8Mn-0.1Cr
25	ASTM	B 211	5056	A95056	—	38/— [262/—]	Bar, Rod & Wire (Cold Finished)	5Mg-0.12Mn-0.12Cu
25	ASTM	B 211	Alclad 5056	A85056	—	37/— [255/—]	Bar, Rod & Wire (Cold Finished)	5Mg-0.12Mn-0.12Cu
25	ASTM	B 221	5083	A95083	—	39/16 [269/110]	Ext. Bar, Rod, Wire, Shapes & Tube	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 221	5086	A95086	—	35/14 [241/97]	Ext. Bar, Rod, Wire, Shapes & Tube	4.0Mg-0.5Mn-0.15Cr
25	ASTM	B 221	5456	A95456	—	41/19 [283/131]	Ext. Bar, Rod, Wire, Shapes & Tube	5.1Mg-0.8Mn-0.1Cr
25	ASTM	B 241	5083	A95083	—	39/16 [269/110]	Ext. Pipe & Tube	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 241	5086	A95086	—	35/14 [241/97]	Ext. Pipe & Tube	4.0Mg-0.5Mn-0.15Cr
25	ASTM	B 241	5456	A95456	—	41/19 [283/131]	Ext. Pipe & Tube	5.1Mg-0.8Mn-0.1Cr
25	ASTM	B 247	5083	A95083	—	39/16 [269/110]	H& Forgings	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 247	5083	A95083	—	39/16 [269/110]	Die Forgings	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 313	5086	A95086	—	35/14 [241/97]	Formed Sheet & Seam Welded Tube	4.0Mg-0.5Mn-0.15Cr
25	ASTM	B 345	5083	A95083	—	39/16 [269/110]	Extruded Seamless Pipe & Tube	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 345	5086	A95086	—	35/14 [241/97]	Extruded Seamless Pipe & Tube	4.0Mg-0.5Mn-0.15Cr
25	ASTM	B 547	5083	A95083	—	40/18 [276/124]	Formed & Arc Seam Welded Tube	4.5Mg-0.8Mn-0.15Cr
25	ASTM	B 547	5086	A95086	—	35/14 [241/97]	Formed & Arc Seam Welded Tube	4.0Mg-0.5Mn-0.15Cr

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Aluminum and Aluminum Base Alloys								
26	ASTM	B 26	208.0 (F)	A02080	—	19/12 [131/83]	Sand Castings	4Cu-3Si
26	ASTM	B 26	222.0 (T61)	A02220	—	23/— [159/—]	Sand Castings	10Cu-0.25Mg
26	ASTM	B 26	319.0 (F, T5, T6)	A03190	—	23/13 [159/90]	Sand Castings	6Si-3.5Cu
26	ASTM	B 26	328.0 (F, T6)	A03280	—	25/14 [172/97]	Sand Castings	8Si-1.5Cu-0.4Mg-0.4Mn
26	ASTM	B 26	356.0 (F)	A03560	—	19/9.5 [131/66]	Sand Castings	7Si-0.35Mg
26	ASTM	B 26	356.0 (T51, T6, T7, T71)	A03560	—	23/— [159/—]	Sand Castings	7Si-0.35Mg
26	ASTM	B 26	443.0 (F)	A04430	—	17/7 [117/48]	Sand Castings	5.2Si
26	ASTM	B 26	514.0 (F)	A05140	—	22/9 [152/62]	Sand Castings	4Mg
26	ASTM	B 26	535.0 (F)	A05350	—	35/18 [241/124]	Sand Castings	6.8Mg-0.18Mn
26	ASTM	B 26	705.0 (T5)	A07050	—	30/17 [207/117]	Sand Castings	3Zn-1.6Mg-0.5Mn-0.3Cr
26	ASTM	B 26	710.0 (T5)	A07100	—	32/20 [221/138]	Sand Castings	6.5Zn-0.7Mg-0.47Cu
26	ASTM	B 26	A356.0 (T6)	A13560	—	23/— [159/—]	Sand Castings	7Si-0.3Mg
26	ASTM	B 26	B443.0 (F)	A24430	—	17/6 [117/41]	Sand Castings	5.2Si
26	ASTM	B 26	512.0 (F)	A05120	—	17/10 [117/69]	Sand Castings	4Mg-1.8Si
26	ASTM	B 108	308.0 (F)	A03080	—	24/— [165/—]	Permanent Mold Casting	5.5Si-4.5Cu
26	ASTM	B 108	319.0 (F, T6)	A03190	—	24/14 [165/97]	Permanent Mold Casting	6Si-3.5Cu
26	ASTM	B 108	333.0 (T5, T6, T7)	A03330	—	28/— [193/—]	Permanent Mold Casting	9Si-3.5Cu-0.3Mn
26	ASTM	B 108	356.0 (F)	A03560	—	21/— [145/—]	Permanent Mold Casting	7Si-0.35Mg
26	ASTM	B 108	356.0 (T51, T6, T7, T71)	A03560	—	23/— [159/—]	Permanent Mold Casting	7Si-0.35Mg
26	ASTM	B 108	443.0 (F)	A04430	—	17/7.0 [117/48]	Permanent Mold Casting	5.2Si
26	ASTM	B 108	513.0 (F)	A05130	—	22/12 [152/83]	Permanent Mold Casting	4Mg-1.8Zn
26	ASTM	B 108	535.0 (F)	A05350	—	35/18 [241/124]	Permanent Mold Casting	6.8Mg-0.18Mn
26	ASTM	B 108	A356.0 (T61)	A13560	—	23/— [159/—]	Permanent Mold Casting	7Si-0.3Mg
26	ASTM	B 108	A444.0 (T4)	A14440	—	17/— [117/—]	Permanent Mold Casting	7Si
26	ASTM	B 108	B443.0 (F)	A24430	—	17/6.0 [117/41]	Permanent Mold Casting	5.2Si

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Aluminum and Aluminum Base Alloys								
26	ASTM	B 618	208.0 (F)	A02080	—	19/12 [131/83]	Investment Castings	4Cu-3Si
26	ASTM	B 618	319.0 (F, T6)	A03190	—	23/13 [159/90]	Investment Castings	6Si-3.5Cu
26	ASTM	B 618	328.0 (F, T6)	A03280	—	25/14 [172/97]	Investment Castings	8Si-1.5Cu-0.4Mg-0.4Mn
26	ASTM	B 618	356.0 (T6, T7, T51, T71)	A03560	—	23/— [159/—]	Investment Castings	7Si-0.35Mg
26	ASTM	B 618	443.0 (F)	A04430	—	177/0 [117/48]	Investment Castings	5.2Si
26	ASTM	B 618	514.0 (F)	A05140	—	22/9.0 [152/62]	Investment Castings	4Mg
26	ASTM	B 618	535.0 (F)	A05350	—	35/18 [241/124]	Investment Castings	6.8Mg-0.18Mn
26	ASTM	B 618	A356.0 (T6)	A13560	—	23/— [159/—]	Investment Castings	7Si-0.3Mg
26	ASTM	B 618	B443.0 (F)	A24430	—	17/6.0 [117/41]	Investment Castings	5.2Si
26	ASTM	B 686	A356.0 (T61)	A13560	—	23/— [159/—]	Investment Castings	7Si-0.3Mg
27	ASTM	B 221	7005 (T53)	A97005	—	40/— [276/—]	Ext. Bar, Rod, Wire, Shapes & Tube	4.5Zn-1.4Mg-0.45Mn-0.13Cr
27	ISO	209	7020 (T5)	A97020	—	40/— [276/—]	Ext. Bar, Rod, Wire, Shapes & Tube	4.5Zn-1.2Mg-0.25Mn-0.18Cr

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
31	ASTM	B 42	Oxygen-Free Cu (OF)	C10200	—	30/9 [207/62]	Seamless Pipe	99.95Cu-Ag
31	ASTM	B 42	Oxygen-Free Cu (OFXLP)	C10300	—	30/9 [207/62]	Seamless Pipe	99.95Cu-0.003P
31	ASTM	B 42	Oxygen-Free Cu (OFLP)	C10800	—	30/9 [207/62]	Seamless Pipe	99.95Cu-0.008P
31	ASTM	B 42	Deoxidized Low P Cu (DLP)	C12000	—	30/9 [207/62]	Seamless Pipe	99.90Cu-Ag-0.008P
31	ASTM	B 42	Deoxidized High P Cu (DHP)	C12200	—	30/9 [207/62]	Seamless Pipe	99.9Cu-0.027P
31	ASTM	B 68	Oxygen-Free Cu (OF)	C10200	—	30/9 [207/62]	Seamless Tube	99.95Cu-Ag
31	ASTM	B 68	Oxygen-Free Cu (OFXLP)	C10300	—	30/9 [207/62]	Seamless Tube	99.95Cu-0.003P
31	ASTM	B 68	Oxygen-Free Cu (OFLP)	C10800	—	30/9 [207/62]	Seamless Tube	99.95Cu-0.008P
31	ASTM	B 68	Deoxidized Low P Cu (DLP)	C12000	—	30/9 [207/62]	Seamless Tube	99.90Cu-Ag-0.008P
31	ASTM	B 68	Deoxidized High P Cu (DHP)	C12200	—	30/9 [207/62]	Seamless Tube	99.9Cu-0.027P
31	ASTM	B 75	Oxygen-Free Cu (OFE)	C10100	—	30/9 [207/62]	Seamless Tube	99.99Cu-Ag
31	ASTM	B 75	Oxygen-Free Cu (OF)	C10200	—	30/9 [207/62]	Seamless Tube	99.95Cu-Ag
31	ASTM	B 75	Oxygen-Free Cu (OFXLP)	C10300	—	30/9 [207/62]	Seamless Tube	99.95Cu-0.003P
31	ASTM	B 75	Oxygen-Free Cu (OFLP)	C10800	—	30/9 [207/62]	Seamless Tube	99.95Cu-0.008P
31	ASTM	B 75	Deoxidized Low P Cu (DHL)	C12000	—	30/9 [207/62]	Seamless Tube	99.9Cu-Ag-0.008P
31	ASTM	B 75	Deoxidized High P Cu (DHP)	C12200	—	30/9 [207/62]	Seamless Tube	99.9Cu-0.027P

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
31	ASTM	B 75	Oxygen-Free Cu (DPA)	C14200	—	30/9 [207/62]	Seamless Tube	99.4Cu-0.3As-0.27P
31	ASTM	B 88	Oxygen Free Cu (OF)	C10200	—	30/— [207/—]	Seamless Tube	99.95Cu-Ag
31	ASTM	B 88	Oxygen Free Cu (OFXLP)	C10300	—	30/9 [207/62]	Seamless Tube	99.95Cu-0.003P
31	ASTM	B 88	Oxygen Free Cu (DLP)	C12000	—	30/— [207/—]	Seamless Tube	99.9Cu-0.008P
31	ASTM	B 88	Oxygen Free Cu (DLP)	C12200	—	30/— [207/—]	Seamless Tube	99.9Cu-0.027P
31	ASTM	B 111	Oxygen-Free Cu (OFE)	C10100	—	30/9 [207/62]	Seamless Tube & Ferrule Stock	99.4Cu-0.3Ag-0.27P
31	ASTM	B 111	Oxygen-Free Cu (OF)	C10200	—	36/— [248/—]	Seamless Tube & Ferrule Stock	99.95Cu-Ag
31	ASTM	B 111	Oxygen-Free Cu (OFXLP)	C10300	—	30/9 [207/62]	Seamless Tube & Ferrule Stock	99.95Cu-0.003P
31	ASTM	B 111	Oxygen-Free Cu (OFLP)	C10800	—	30/9 [207/62]	Seamless Tube & Ferrule Stock	99.95Cu-0.008P
31	ASTM	B 111	Oxygen-Free Cu (DLP)	C12000	—	30/9 [207/62]	Seamless Tube & Ferrule Stock	99.9Cu-Ag
31	ASTM	B 111	Oxygen-Free Cu (DHP)	C12200	—	30/9 [207/62]	Seamless Tube & Ferrule Stock	99.9Cu-0.027P
31	ASTM	B 111	Oxygen-Free Cu (DPA)	C14200	—	30/9 [207/62]	Seamless Tube & Ferrule Stock	99.4Cu-0.3Ag-0.27P
31	ASTM	B 111	98.5 min Cu	C19200	—	38/12 [262/83]	Seamless Tube & Ferrule Stock	98.7Cu-1Fe-0.025P
31	ASTM	B 152	Oxygen-Free Cu (OFE)	C10100	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.4Cu-0.3Ag-0.27P
31	ASTM	B 152	Oxygen-Free Cu (OF)	C10200	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.95Cu-Ag
31	ASTM	B 152	Oxygen-Free Cu (OFXLP)	C10300	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.95Cu-0.003P

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
31	ASTM	B 152	Oxygen-Free Cu (OFS)	C10400	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.95Cu-0.027Ag
31	ASTM	B 152	Oxygen-Free Cu (OFS)	C10500	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.95Cu-0.034Ag
31	ASTM	B 152	Oxygen-Free Cu (OFS)	C10700	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.95Cu-0.085Ag
31	ASTM	B 152	Oxygen-Free Cu (OFLP)	C10800	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.95Cu-0.008P
31	ASTM	B 152	Oxygen-Free Cu (DLP)	C12000	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.9Cu-Ag
31	ASTM	B 152	Oxygen-Free Cu (DHP)	C12200	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.9Cu-0.027P
31	ASTM	B 152	Oxygen-Free Cu (DPS)	C12300	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.9Cu-0.027P
31	ASTM	B 152	Oxygen-Free Cu (DPA)	C14200	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.4Cu-0.3Ag-0.27P
31	ASTM	B 152	Sn Bearing Tellurium Cu	C14420	—	30/9 [207/62]	Plate, Sheet, Strip & Rolled Bar	99.9Cu-0.10Sn-0.02Te
31	ASTM	B 170	Oxygen-Free Electronic Cu (OFE)	C10100	—	30/9 [207/62]	Refinery Shapes	99.4Cu-0.3Ag-0.27P
31	ASTM	B 170	Oxygen-Free Electronic Cu (OF)	C10200	—	30/9 [207/62]	Refinery Shapes	99.95Cu-Ag
31	ASTM	B 187	Oxygen-Free Cu (OFE)	C10100	—	28/- [193/-]	Rod	99.99Cu
31	ASTM	B 187	Oxygen-Free Cu (OF)	C10200	—	28/- [193/-]	Rod	99.95Cu-Ag
31	ASTM	B 187	Oxygen-Free Cu (OFXLP)	C10300	—	28/- [193/-]	Rod	99.95Cu-0.003P
31	ASTM	B 187	Oxygen-Free Cu with Ag (OFS)	C10400	—	28/- [193/-]	Rod	99.95Cu-0.027Ag

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
31	ASTM	B 187	Oxygen-Free Cu with Ag (OFS)	C10700	—	28/— [193/—]	Rod	99.95Cu-0.085Ag
31	ASTM	B 187	Controlled Oxygen Cu	C10940	—	28/— [193/—]	Rod	99.90minCu-Ag
31	ASTM	B 187	Sn Bearing Tellurium Cu	C14420	—	28/— [193/—]	Rod	99.9Cu-0.10Sn-0.02Te
31	ASTM	B 187	Oxygen-Free Cu (OFE)	C10100	—	28/— [193/—]	Bars	99.99Cu
31	ASTM	B 187	Oxygen-Free Cu (OF)	C10200	—	28/— [193/—]	Bars	99.95Cu-Ag
31	ASTM	B 187	Oxygen-Free Cu (OFXLP)	C10300	—	28/— [193/—]	Bars	99.95Cu-0.003P
31	ASTM	B 187	Oxygen-Free Cu with Ag (OFS)	C10400	—	28/— [193/—]	Bars	99.95Cu-0.027Ag
31	ASTM	B 187	Oxygen-Free Cu with Ag (OFS)	C10700	—	28/— [193/—]	Bars	99.95Cu-0.085Ag
31	ASTM	B 187	Controlled Oxygen Cu	C10940	—	28/— [193/—]	Bars	99.90minCu-Bar
31	ASTM	B 187	Sn Bearing Tellurium Cu	C14420	—	28/— [193/—]	Bars	99.9Cu-0.10Sn-0.02Te
31	ASTM	B 187	Oxygen-Free Cu (OFE)	C10100	—	28/— [193/—]	Rolled Shapes	99.99Cu
31	ASTM	B 187	Oxygen-Free Cu (OF)	C10200	—	28/— [193/—]	Rolled Shapes	99.95Cu-Ag
31	ASTM	B 187	Oxygen-Free Cu (OFXLP)	C10300	—	28/— [193/—]	Rolled Shapes	99.95Cu-0.003P
31	ASTM	B 187	Oxygen-Free Cu with Ag (OFS)	C10400	—	28/— [193/—]	Rolled Shapes	99.95Cu0.027Ag
31	ASTM	B 187	Oxygen-Free Cu with Ag (OFS)	C10700	—	28/— [193/—]	Rolled Shapes	99.95Cu-0.085Ag
31	ASTM	B 187	Controlled Oxygen Cu	C10940	—	28/— [193/—]	Rolled Shapes	99.90minCu-Ag

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
31	ASTM	B 187	Sn Bearing Tellurium Cu	C14420	—	28/— [193/—]	Rolled Shapes	99.9Cu-0.10Sn-0.02Te
31	ASTM	B 280	Oxygen-free Cu (OF)	C10200	—	—	Seamless Tube	99.95Cu+Ag
31	ASTM	B 280	Deoxidized Cu (DLP)	C12000	—	—	Seamless Tube	99.9Cu+Ag
31	ASTM	B 280	Deoxidized Cu (DHP)	C12200	—	30/9 [207/62]	Seamless Tube	99.9Cu-0.027P
31	ASTM	B 359	Oxygen-Free Cu (OFE)	C10100	—	30/9 [207/62]	Seamless Tube	99.99Cu
31	ASTM	B 359	Oxygen-Free Cu (OF)	C10200	—	30/9 [207/62]	Seamless Tube	99.95Cu-Ag
31	ASTM	B 359	Oxygen-Free Cu (OFXLP)	C10300	—	30/9 [207/62]	Seamless Tube	99.95Cu-0.003P
31	ASTM	B 359	Oxygen-Free Low P Cu (OFLP)	C10800	—	30/9 [207/62]	Seamless Tube	99.95Cu-0.008P
31	ASTM	B 359	Deoxidized Low P Cu (DLP)	C12000	—	30/9 [207/62]	Seamless Tube	99.9Cu-Ag-0.008P
31	ASTM	B 359	Deoxidized High P Cu (DHP)	C12200	—	30/9 [207/62]	Seamless Tube	99.9Cu-0.027P
31	ASTM	B 359	Deoxidized As-Cu (DPA)	C14200	—	30/9 [207/62]	Seamless Tube	99.4Cu-0.3As-0.027P
31	ASTM	B 359	98.7 min Cu	C19200	—	30/9 [207/62]	Seamless Tube	98.7Cu-1Fe-0.025P
31	ASTM	B 395	Oxygen-Free Cu (OF)	C10200	—	30/9 [207/62]	Seamless Tube	99.95Cu-Ag
31	ASTM	B 395	Oxygen-Free Cu (OFXLP)	C10300	—	30/9 [207/62]	Seamless Tube	99.95Cu-0.003P
31	ASTM	B 395	Oxygen-Free Low P Cu (OFLP)	C10800	—	30/9 [207/62]	Seamless Tube	99.95Cu-0.008P
31	ASTM	B 395	Deoxidized Low P Cu (DLP)	C12000	—	30/9 [207/62]	Seamless Tube	99.9Cu-Ag

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
31	ASTM	B 395	Deoxidized High P Cu (DHP)	C12200	—	30/9 [207/62]	Seamless Tube	99.9Cu-0.027P
31	ASTM	B 395	Deoxidized As-Cu (DPA)	C14200	—	30/9 [207/62]	Seamless Tube	99.4Cu-0.3Ag-0.027P
31	ASTM	B 395	98.7 min Cu	C19200	—	30/9 [207/62]	Seamless Tube	98.7Cu-1Fe-0.025P
31	ASTM	B 543	Oxygen-Free Low P Cu (OFLP)	C10800	—	30/9 [207/62]	Welded Tube	99.95Cu-0.008P
31	ASTM	B 543	Deoxidized High P Cu (DHP)	C12200	—	30/9 [207/62]	Welded Tube	99.9Cu-0.027P
31	ASTM	B 543	97.0 min Cu	C19400	—	45/15 [310/103]	Welded Tube	97Cu-2.3Fe-0.08P
31	ASTM	B 819	Deoxidized High P Cu (DHP)	C12200	—	30/9 [207/62]	Seamless Tube	99.9Cu-0.027P
32	ASTM	B 21	Alloy A Naval Brass	C46400	≤1.00 [25] O.D.	54/20 [372/138]	Rod & Bar	60.5Cu-38Zn-0.75Sn
32	ASTM	B 21	Alloy A Naval Brass	C46400	>1.00 ≤2.00 >25 ≤50]	52/20 [359/138]	Rod & Bar	60.5Cu-38Zn-0.75Sn
32	ASTM	B 21	Alloy A Naval Brass	C46400	>2.00 [50]	50/20 [345/138]	Rod & Bar	60.5Cu-38Zn-0.75Sn
32	ASTM	B 21	Alloy A Naval Brass	C46400	—	52/20 [359/138]	Shapes	60.5Cu-38Zn-0.75Sn
32	ASTM	B 43	Red Brass, 85%	C23000	—	40/12 [276/83]	Seamless Pipe	85Cu-15Zn
32	ASTM	B 111	Red Brass, 85%	C23000	—	40/12 [276/83]	Seamless Tube & Ferrule Stock	85Cu-15Zn
32	ASTM	B 111	Muntz Metal	C28000	—	50/20 [345/138]	Seamless Tube & Ferrule Stock	61Cu-38Zn
32	ASTM	B 111	Admiralty, A	C44300	—	45/15 [310/103]	Seamless Tube & Ferrule Stock	71.5Cu-28Zn-1Sn-0.04Ag
32	ASTM	B 111	Admiralty, B	C44400	—	45/15 [310/103]	Seamless Tube & Ferrule Stock	71.5Cu-28Zn-1Sn-0.06Sb
32	ASTM	B 111	Admiralty, C	C44500	—	45/15 [310/103]	Seamless Tube & Ferrule Stock	71.5Cu-28Zn-1Sn-0.06P
32	ASTM	B 111	Aluminum Brass B	C68700	—	50/18 [345/123]	Seamless Tube & Ferrule Stock	67.5Cu-31Zn-1.9Al-0.04Ag
32	ASTM	B 135	Commercial Bronze, 90%	C22000	—	38/12 [262/83]	Seamless Tube	90Cu-9.8Zn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
32	ASTM	B 135	Red Brass, 85%	C23000	—	40/12 [276/83]	Seamless Tube	85Cu-15Zn
32	ASTM	B 171	Leaded Muntz Metal	C36500	≤2.00 [50]	50/20 [345/138]	Plate & Sheet	59.5Cu-40Zn-0.5Pb
32	ASTM	B 171	Leaded Muntz Metal	C36500	>2.0 ≤3.5 [>50 ≤89]	45/15 [310/103]	Plate & Sheet	59.5Cu-40Zn-0.5Pb
32	ASTM	B 171	Leaded Muntz Metal	C36500	>3.5 ≤5.0 [>89 ≤125]	40/12 [276/83]	Plate & Sheet	59.5Cu-40Zn-0.5Pb
32	ASTM	B 171	Admiralty, A	C44300	≤4.0 [100]	45/15 [310/103]	Plate & Sheet	71.5Cu-28Zn-1Sn-0.04Ag
32	ASTM	B 171	Admiralty, B	C44400	≤4.0 [100]	45/15 [310/103]	Plate & Sheet	71.5Cu-28Zn-1Sn-0.06Sb
32	ASTM	B 171	Admiralty, C	C44500	≤4.0 [100]	45/15 [310/103]	Plate & Sheet	71.5Cu-28Zn-1Sn-0.06P
32	ASTM	B 171	Naval Brass	C46400	≤3.0 [75]	50/20 [345/138]	Plate & Sheet	60.5Cu-38Zn-0.75Sn
32	ASTM	B 171	Naval Brass	C46400	>3 ≤5 [>75 ≤125]	50/18 [345/123]	Plate & Sheet	60.5Cu-38Zn-0.75Sn
32	ASTM	B 171	Naval Brass, Arsenical	C46500	≤3.0 [75]	50/20 [345/138]	Plate & Sheet	60.5Cu-38Zn-0.75Sn-0.04Ag
32	ASTM	B 171	Naval Brass, Arsenical	C46500	>3 ≤5 [>75 ≤125]	50/18 [345/123]	Plate & Sheet	60.5Cu-38Zn-0.75Sn-0.04Ag
32	ASTM	B 359	Red Brass, 85%	C23000	—	40/12 [276/83]	Seamless Tube	85Cu-15Zn
32	ASTM	B 359	Admiralty, A	C44300	—	45/15 [310/103]	Seamless Tube	71.5Cu-28Zn-1Sn-0.04As
32	ASTM	B 359	Admiralty, B	C44400	—	45/15 [310/103]	Seamless Tube	71.5Cu-28Zn-1Sn-0.06Sb
32	ASTM	B 359	Admiralty, C	C44500	—	45/15 [310/103]	Seamless Tube	71.5Cu-28Zn-1Sn-0.06P
32	ASTM	B 359	Aluminum Brass B	C68700	—	50/18 [345/123]	Seamless Tube	77.5Cu-31Zn-1.9Al-0.04As
32	ASTM	B 395	Red Brass, 85%	C23000	—	40/12 [276/83]	Seamless Tube	85Cu-15Zn
32	ASTM	B 395	Admiralty, A	C44300	—	45/15 [310/103]	Seamless Tube	71.5Cu-28Zn-1Sn-0.04Ag
32	ASTM	B 395	Admiralty, B	C44400	—	45/15 [310/103]	Seamless Tube	71.5Cu-28Zn-1Sn-0.06Sb
32	ASTM	B 395	Admiralty, C	C44500	—	45/15 [310/103]	Seamless Tube	71.5Cu-28Zn-1Sn-0.06P
32	ASTM	B 395	Aluminum Brass B	C68700	—	50/18 [345/123]	Seamless Tube	67.5Cu-31Zn-1.9Al-0.04Ag
32	ASTM	B 543	Red Brass, 85%	C23000	—	40/12 [276/83]	Welded Tube	85Cu-15Zn
32	ASTM	B 543	Admiralty, A	C44300	—	45/15 [310/103]	Welded Tube	71.5Cu-28Zn-1Sn-0.04Ag

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
32	ASTM	B 543	Admiralty, B	C44400	—	45/15 [310/103]	Welded Tube	71.5Cu-28Zn-1Sn-0.06Sb
32	ASTM	B 543	Admiralty, C	C44500	—	45/15 [310/103]	Welded Tube	71.5Cu-28Zn-1Sn-0.06P
32	ASTM	B 543	Aluminum Brass B	C68700	—	50/18 [345/123]	Welded Tube	67.5Cu-31Zn-1.9Al-0.04Ag
33	ASTM	B 96	Low Si Bronze B	C65100	—	38/— [262/—]	Plate, Sheet, Strip & Rolled Bar	96Cu-0.14Si
33	ASTM	B 96	Silicon Bronze	C65400	—	65/— [448/—]	Plate, Sheet, Strip & Rolled Bar	95Cu-3Si-1.5Sn
33	ASTM	B 96	High Si Bronze A	C65500	—	52/— [359/—]	Plate, Sheet, Strip & Rolled Bar	93Cu-3.3Si-0.9Mn
33	ASTM	B 98	Low Si Bronze B	C65100	—	40/12 [276/83]	Rod, Bars & Shapes	96Cu-0.14Si
33	ASTM	B 98	High Si Bronze A	C65500	—	52/15 [359/103]	Rod, Bars & Shapes	93Cu-3.3Si-0.9Mn
33	ASTM	B 98	Silicon Bronze	C66100	—	52/15 [359/103]	Rod, Bars & Shapes	93Cu-3.15Si-0.5Pb
33	ASTM	B 283	High Si Bronze A	C65500	—	50/15 [345/103]	Die Forgings	93Cu-3.3Si-0.9Mn
33	ASTM	B 315	Low Si Bronze B	C65100	—	40/10 [276/69]	Pipe	96Cu-0.14Si
33	ASTM	B 315	High Si Bronze A	C65500	—	50/15 [345/103]	Pipe	93Cu-3.3Si-0.9Mn
33	ASTM	B 315	Low Si Bronze B	C65100	—	40/10 [276/69]	Tube	96Cu-0.14Si
33	ASTM	B 315	High Si Bronze A	C65500	—	50/15 [345/103]	Tube	93Cu-3.3Si-0.9Mn
34	ASTM	B 111	95-5 Cu-Ni	C70400	—	38/12 [262/83]	Seamless Tube & Ferrule Stock	92Cu-5.5Ni-1.5Fe-0.55Mn
34	ASTM	B 111	90-10 Cu-Ni	C70600	—	40/15 [276/103]	Seamless Tube & Ferrule Stock	87Cu-10Ni-1.4Fe
34	ASTM	B 111	80-20 Cu-Ni	C71000	—	45/16 [310/110]	Seamless Tube & Ferrule Stock	78Cu-21Ni-0.75Fe
34	ASTM	B 111	70-30 Cu-Ni	C71500	—	52/18 [359/124]	Seamless Tube & Ferrule Stock	68Cu-31Ni-0.7Fe
34	ASTM	B 111	Cu-Ni-Fe-Mn	C71640	—	63/25 [434/172]	Seamless Tube & Ferrule Stock	65Cu-30.5Ni-2Fe-2Mn
34	ASTM	B 111	85-15 Cu-Ni	C72200	—	45/16 [310/110]	Seamless Tube & Ferrule Stock	82Cu-16.5Ni-0.75Fe-0.5Cr
34	ASTM	B 151	90-10 Cu-Ni	C70600	—	38/15 [262/103]	Rod, Bars & Shapes	87Cu-10Ni-1.4Fe
34	ASTM	B 151	70-30 Cu-Ni	C71500	≤1/2 [13]	52/18 [359/124]	Round, Hex. & Oct. Rods & Square Bar	68Cu-31Ni-0.7Fe
34	ASTM	B 151	70-30 Cu-Ni	C71500	>1/2 ≤1 [13 ≤25]	48/18 [331/124]	Round, Hex. & Oct. Rods & Square Bar	68Cu-31Ni-0.7Fe
34	ASTM	B 151	70-30 Cu-Ni	C71500	>1.0 [25]	45/18 [310/124]	Round, Hex. & Oct. Rods & Square Bar	68Cu-31Ni-0.7Fe
34	ASTM	B 151	70-30 Cu-Ni	C71500	—	45/15 [310/103]	Rectangular Bars & Shapes	68Cu-31Ni-0.7Fe
34	ASTM	B 171	90-10 Cu-Ni	C70600	—	40/15 [276/103]	Plate & Sheet	87Cu-10Ni-1.4Fe

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
34	ASTM	B 171	70-30 Cu-Ni	C71500	≤2.5 [64]	50/20 [345/138]	Plate & Sheet	68Cu-31Ni-0.7Fe
34	ASTM	B 171	70-30 Cu-Ni	C71500	>2.5 ≤5.0 [64 ≤125]	45/18 [310/124]	Plate & Sheet	68Cu-31Ni-0.7Fe
34	ASTM	B 171	85-15 Cu-Ni	C72200	≤2.5 [64]	42/16 [290/110]	Plate & Sheet	82Cu-16.5Ni-0.75Fe-0.5Cr
34	ASTM	B 359	95-5 Cu-Ni	C70400	—	38/12 [262/83]	Seamless Tube	92Cu-5.5Ni-1.5Fe-0.55Mn
34	ASTM	B 359	90-10 Cu-Ni	C70600	—	40/15 [276/103]	Seamless Tube	87Cu-10Ni-1.4Fe
34	ASTM	B 359	80-20 Cu-Ni	C71000	—	45/16 [310/110]	Seamless Tube	78Cu-21Ni-0.75Fe
34	ASTM	B 359	70-30 Cu-Ni	C71500	—	52/18 [359/124]	Seamless Tube	68Cu-31Ni-0.7Fe
34	ASTM	B 359	85-15 Cu-Ni	C72200	—	45/16 [310/110]	Seamless Tube	82Cu-16.5Ni-0.75Fe-0.5Cr
34	ASTM	B 395	95-5 Cu-Ni	C70400	—	38/12 [262/83]	Seamless Tube	92Cu-5.5Ni-1.5Fe-0.55Mn
34	ASTM	B 395	90-10 Cu-Ni	C70600	—	40/15 [276/103]	Seamless Tube	87Cu-10Ni-1.4Fe
34	ASTM	B 395	80-20 Cu-Ni	C71000	—	45/16 [310/110]	Seamless Tube	78Cu-21Ni-0.75Fe
34	ASTM	B 395	70-30 Cu-Ni	C71500	—	52/18 [359/124]	Seamless Tube	68Cu-31Ni-0.7Fe
34	ASTM	B 395	85-15 Cu-Ni	C72200	—	45/16 [310/110]	Seamless Tube	82Cu-16.5Ni-0.75Fe-0.5Cr
34	ASTM	B 466	95-5 Cu-Ni	C70400	—	37/12 [255/83]	Seamless Pipe & Tube	92Cu-5.5Ni-1.5Fe-0.55Mn
34	ASTM	B 466	90-10 Cu-Ni	C70600	—	38/13 [262/90]	Seamless Pipe & Tube	87Cu-10Ni-1.4Fe
34	ASTM	B 466	80-20 Cu-Ni	C71000	—	45/16 [310/110]	Seamless Pipe & Tube	78Cu-21Ni-0.75Fe
34	ASTM	B 466	70-30 Cu-Ni	C71500	—	52/18 [359/124]	Seamless Pipe & Tube	68Cu-31Ni-0.7Fe
34	ASTM	B 466	85-15 Cu-Ni	C72200	—	40/14 [276/97]	Seamless Pipe & Tube	82Cu-16.5Ni-0.75Fe-0.5Cr
34	ASTM	B 467	90-10 Cu-Ni	C70600	≤4.5 [114]	40/15 [276/103]	Welded Pipe	87Cu-10Ni-1.4Fe
34	ASTM	B 467	90-10 Cu-Ni	C70600	>4.5 [114]	38/13 [262/90]	Welded Pipe	87Cu-10Ni-1.4Fe
34	ASTM	B 467	70-30 Cu-Ni	C71500	≤4.5 [114]	50/20 [345/138]	Welded Pipe	68Cu-31Ni-0.7Fe
34	ASTM	B 467	70-30 Cu-Ni	C71500	>4.5 [114]	45/15 [310/103]	Welded Pipe	68Cu-31Ni-0.7Fe
34	ASTM	B 543	95-5 Cu-Ni	C70400	—	38/12 [262/83]	Welded Tube	92Cu-5.5Ni-1.5Fe-0.55Mn
34	ASTM	B 543	90-10 Cu-Ni	C70600	—	40/15 [276/103]	Welded Tube	87Cu-10Ni-1.4Fe
34	ASTM	B 543	80-20 Cu-Ni	C71000	—	45/16 [310/110]	Welded Tube	78Cu-21Ni-0.75Fe
34	ASTM	B 543	70-30 Cu-Ni	C71500	—	52/18 [359/124]	Welded Tube	68Cu-31Ni-0.7Fe
34	ASTM	B 543	Cu-Ni-Fe-Mn	C71640	—	63/25 [434/172]	Welded Tube	65Cu-30Ni-2Fe-2Mn
34	ASTM	B 543	85-15 Cu-Ni	C72200	—	45/16 [310/110]	Welded Tube	82Cu-16.5Ni-0.75Fe-0.5Cr

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
34	ASTM	B 608	90-10 Cu-Ni	C70620	—	40/— [276/—]	Welded Pipe	87Cu-10Ni-1.4Fe
34	ASTM	B 608	70-30 Cu-Ni	C71520	—	50/— [345/—]	Welded Pipe	68Cu-31Ni-0.7Fe
35	ASTM	B 111	Aluminum Bronze	C60800	—	50/19 [345/131]	Seamless Tube & Ferrule Stock	94Cu-5.8Al-0.2As
35	ASTM	B 111	Aluminum Bronze	C61300	—	70/30 [483/207]	Seamless Tube & Ferrule Stock	91Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 111	Aluminum Bronze D	C61400	—	70/30 [483/207]	Seamless Tube & Ferrule Stock	87Cu-7.0Al-2.5Fe
35	ASTM	B 148	Grade A, Al-Bronze	C95200	—	65/25 [448/172]	Sand Castings	88Cu-9Al-3Fe
35	ASTM	B 148	Grade B, Al-Bronze	C95300	—	65/25 [448/172]	Sand Castings	89Cu-10Al-1Fe
35	ASTM	B 148	Grade C, Al-Bronze	C95400	—	75/30 [517/207]	Sand Castings	85Cu-11Al-4Fe
35	ASTM	B 148	Aluminum Bronze	C95410	—	75/30 [517/207]	Sand Castings	83Cu-10.7Al-4Fe-2Ni
35	ASTM	B 148	Grade D, Ni-Al Bronze	C95500	—	90/40 [621/276]	Sand Castings	85Cu-11Al-4Fe-3Mn
35	ASTM	B 148	Grade E, Si-Al Bronze	C95600	—	60/28 [414/193]	Sand Castings	91Cu-7Al-2Si
35	ASTM	B 148	Grade F, Mn-Ni-Al Bronze	C95700	—	90/40 [621/276]	Sand Castings	75Cu-12Mn-8Al-3Fe-2Ni
35	ASTM	B 148	Ni-Al Bronze	C95800	—	85/35 [586/241]	Sand Castings	81Cu-9Al-4.5Ni-4Fe
35	ASTM	B 150	Aluminum Bronze	C61300	≤0.50 [13]	80/40 [552/276]	Hex. & Oct. Rod & Bar	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 150	Aluminum Bronze	C61300	>0.5 ≤1.0 [≥13 ≤25]	75/35 [517/241]	Hex. & Oct. Rod & Bar	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 150	Aluminum Bronze	C61300	>1.0 ≤2.0 [≥25 ≤50]	70/32 [483/221]	Hex. & Oct. Rod & Bar	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 150	Aluminum Bronze	C61300	≤0.50 [13]	80/50 [552/345]	Round Rod	90Cu-6.8Al-2.5Fe-0.35Sn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
35	ASTM	B 150	Aluminum Bronze	C61300	>0.5 ≤1.0 [>13 ≤25]	75/45 [517/310]	Round Rod	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 150	Aluminum Bronze	C61300	>1.0 ≤2.0 [>25 ≤50]	72/40 [496/276]	Round Rod	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 150	Aluminum Bronze	C61300	>2.0 ≤3.0 [>50 ≤75]	70/35 [483/241]	Round Rod	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 150	Aluminum Bronze D	C61400	≤0.5 [13]	80/40 [552/276]	Round Rod	90Cu-7Al-2.5Fe
35	ASTM	B 150	Aluminum Bronze D	C61400	>0.5 ≤1.0 [>13 ≤25]	75/35 [517/241]	Round Rod	90Cu-7Al-2.5Fe
35	ASTM	B 150	Aluminum Bronze D	C61400	>1.0 ≤2.0 [>25 ≤50]	70/32 [483/221]	Round Rod	90Cu-7Al-2.5Fe
35	ASTM	B 150	Aluminum Bronze D	C61400	>2.0 ≤3.0 [>50 ≤75]	70/30 [483/207]	Round Rod	90Cu-7Al-2.5Fe
35	ASTM	B 150	Aluminum Bronze	C61900	≤0.5 [13]	90/50 [621/345]	Round Rod	86Cu-9Al-3.7Fe
35	ASTM	B 150	Aluminum Bronze	C61900	>0.5 ≤1.0 [>13 ≤25]	88/44 [607/303]	Round Rod	86Cu-9Al-3.7Fe
35	ASTM	B 150	Aluminum Bronze	C61900	>1.0 ≤2.0 [>25 ≤50]	85/40 [586/276]	Round Rod	86Cu-9Al-3.7Fe
35	ASTM	B 150	Aluminum Bronze	C61900	>2.0 ≤3.0 [>50 ≤75]	78/37 [538/255]	Round Rod	86Cu-9Al-3.7Fe
35	ASTM	B 150	Aluminum Bronze	C61900	>3.0 [75]	75/30 [517/207]	Round Rod	86Cu-9Al-3.7Fe
35	ASTM	B 150	Aluminum Bronze	C61900	—	75/30 [517/207]	Shapes	86Cu-9Al-3.7Fe
35	ASTM	B 150	Aluminum Bronze	C62300	<0.5 [13]	90/50 [621/345]	Round Rod	86Cu-9.7Al-3Fe
35	ASTM	B 150	Aluminum Bronze	C62300	>0.5 ≤1.0 [>13 ≤25]	88/44 [607/303]	Round Rod	86Cu-9.7Al-3Fe
35	ASTM	B 150	Aluminum Bronze	C62300	>1.0 ≤2.0 [>25 ≤50]	84/40 [579/276]	Round Rod	86Cu-9.7Al-3Fe

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
35	ASTM	B 150	Aluminum Bronze	C62300	>2.0 ≤3.0 [≥50 ≤75]	76/37 [524/255]	Round Rod	86Cu-9.7Al-3Fe
35	ASTM	B 150	Aluminum Bronze	C62300	>3.0 [75]	75/30 [517/207]	Round Rod	86Cu-9.7Al-3Fe
35	ASTM	B 150	Aluminum Bronze	C62300	≤1.0 [25]	80/35 [552/241]	Hex. & Oct. Rod & Bar	86Cu-9.7Al-3Fe
35	ASTM	B 150	Aluminum Bronze	C62300	>1.0 ≤2.0 [≥25 ≤50]	78/32 [538/221]	Hex. & Oct. Rod & Bar	86Cu-9.7Al-3Fe
35	ASTM	B 150	Aluminum Bronze	C62300	>2.0 [50]	75/30 [517/207]	Hex. & Oct. Rod & Bar	86Cu-9.7Al-3Fe
35	ASTM	B 150	Aluminum Bronze	C62300	—	75/30 [517/207]	Shapes	86Cu-9.7Al-3Fe
35	ASTM	B 150	Aluminum Bronze	C62400	≤1.0 [25]	95/45 [655/310]	Round Rod	85.5Cu-10.8Al-3.2Fe
35	ASTM	B 150	Aluminum Bronze	C62400	>1.0 ≤2.0 [≥25 ≤50]	90/43 [621/296]	Round Rod	85.5Cu-10.8Al-3.2Fe
35	ASTM	B 150	Aluminum Bronze	C62400	>2.0 ≤3.0 [≥50 ≤75]	90/40 [621/276]	Round Rod	85.5Cu-10.8Al-3.2Fe
35	ASTM	B 150	Aluminum Bronze	C62400	>3.0 ≤5.0 [≥75 ≤125]	90/35 [621/241]	Round Rod	85.5Cu-10.8Al-3.2Fe
35	ASTM	B 150	Aluminum Bronze	C62400	0.5 ≤5.0 [13 ≤125]	90/35 [621/241]	Hex. & Oct. Rod & Bar	85.5Cu-10.8Al-3.2Fe
35	ASTM	B 150	Aluminum Bronze	C62400	—	90/35 [621/241]	Shapes	85.5Cu-10.8Al-3.2Fe
35	ASTM	B 150	Aluminum Bronze	C63000	0.5 ≤1.0 [13 ≤25]	100/50 [689/345]	Rod & Bar	82Cu-10Al-5Ni-3Fe
35	ASTM	B 150	Aluminum Bronze	C63000	>1.0 ≤2.0 [≥25 ≤50]	90/45 [621/310]	Rod & Bar	82Cu-10Al-5Ni-3Fe
35	ASTM	B 150	Aluminum Bronze	C63000	>2.0 ≤4.0 [≥50 ≤100]	85/42.5 [586/293]	Rod & Bar	82Cu-10Al-5Ni-3Fe
35	ASTM	B 150	Aluminum Bronze	C63000	>4.0 [100]	80/40 [552/276]	Rod & Bar	82Cu-10Al-5Ni-3Fe

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
35	ASTM	B 150	Aluminum Bronze	C63000	—	85/42.5 [586/293]	Shapes	82Cu-10Al-5Ni-3Fe
35	ASTM	B 150	Aluminum Bronze	C63020	≤1.0 [25]	135/100 [931/689]	Rod & Bar	74.5minCu-11Al-5.1Ni-4.8Fe
35	ASTM	B 150	Aluminum Bronze	C63020	>1.0 ≤2.0 [>25 ≤50]	130/95 [896/655]	Rod & Bar	74.5minCu-11Al-5.1Ni-4.8Fe
35	ASTM	B 150	Aluminum Bronze	C63020	>2.0 ≤4.0 [>50 ≤100]	130/90 [896/621]	Rod & Bar	74.5minCu-11Al-5.1Ni-4.8Fe
35	ASTM	B 150	Aluminum Bronze	C63200	—	90/40 [621/276]	Rod, Bars & Shapes	81Cu-9.1Al-4.4Ni-3.9Fe-1.6Mn
35	ASTM	B 150	Aluminum Bronze	C64200	≤0.5 [13]	90/45 [621/310]	Rod & Bar	89Cu-6.9Al-1.8Si
35	ASTM	B 150	Aluminum Bronze	C64200	>0.5 ≤1.0	85/45 [586/310]	Rod & Bar	89Cu-6.9Al-1.8Si
35	ASTM	B 150	Aluminum Bronze	C64200	>1.0 ≤2.0 [>25 ≤50]	80/42 [552/290]	Rod & Bar	89Cu-6.9Al-1.8Si
35	ASTM	B 150	Aluminum Bronze	C64200	>2.0 ≤3.0 [>50 ≤75]	75/35 [517/241]	Rod & Bar	89Cu-6.9Al-1.8Si
35	ASTM	B 150	Aluminum Bronze	C64200	>3.0 ≤4.0 [>75 ≤100]	70/30 [483/207]	Rod & Bar	89Cu-6.9Al-1.8Si
35	ASTM	B 150	Aluminum Bronze	C64200	>4.0 [100]	70/25 [483/172]	Rod & Bar	89Cu-6.9Al-1.8Si
35	ASTM	B 150	Aluminum Bronze	C64200	—	70/30 [483/207]	Shapes	89Cu-6.9Al-1.8Si
35	ASTM	B 169	Aluminum Bronze	C61300	≤0.5 [13]	75/36 [517/248]	Sheet, Strip & Rolled Bar	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 169	Aluminum Bronze	C61300	>0.5 ≤2.0 [>13 ≤50]	72/32 [496/221]	Sheet, Strip & Rolled Bar	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 169	Aluminum Bronze	C61300	>2.0 ≤5.0 [>50 ≤125]	65/28 [448/193]	Sheet, Strip & Rolled Bar	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 169	Aluminum Bronze D	C61400	≤0.5 [13]	72/32 [496/221]	Sheet, Strip & Rolled Bar	90Cu-7Al-2.5Fe

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
35	ASTM	B 169	Aluminum Bronze D	C61400	>0.5 ≤2.0 [>13 ≤50]	70/30 [483/207]	Sheet, Strip & Rolled Bar	90Cu-7Al-2.5Fe
35	ASTM	B 169	Aluminum Bronze D	C61400	>2.0 ≤5.0 [>50 ≤125]	65/28 [448/193]	Sheet, Strip & Rolled Bar	90Cu-7Al-2.5Fe
35	ASTM	B 171	Aluminum Bronze	C61300	≤2.0 [50]	75/37 [517/255]	Plate & Sheet	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 171	Aluminum Bronze	C61300	>2.0 ≤3.0 [>50 ≤75]	70/30 [483/207]	Plate & Sheet	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 171	Aluminum Bronze	C61300	>3.0 ≤5.0 [>75 ≤125]	65/28 [448/193]	Plate & Sheet	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 171	Aluminum Bronze D	C61400	≤2.0 [50]	70/30 [483/207]	Plate & Sheet	90Cu-7Al-2.5Fe
35	ASTM	B 171	Aluminum Bronze D	C61400	>2.0 ≤5.0 [>50 ≤125]	65/28 [448/193]	Plate & Sheet	90Cu-7Al-2.5Fe
35	ASTM	B 171	Aluminum Bronze	C63000	≤2.0 [50]	90/36 [621/248]	Plate & Sheet	82Cu-10Al-5Ni-3Fe
35	ASTM	B 171	Aluminum Bronze	C63000	>2.0 ≤3.5 [>50 ≤89]	85/33 [586/228]	Plate & Sheet	82Cu-10Al-5Ni-3Fe
35	ASTM	B 171	Aluminum Bronze	C63000	>3.5 ≤5.0 [>89 ≤125]	80/30 [552/207]	Plate & Sheet	82Cu-10Al-5Ni-3Fe
35	ASTM	B 171	Aluminum Bronze	C63200	≤2.0 [50]	90/36 [621/248]	Plate & Sheet	81Cu-9.1Al-4.4Ni-3.9Fe-1.6Mn
35	ASTM	B 171	Aluminum Bronze	C63200	>2.0 ≤3.5 [>50 ≤89]	85/33 [586/228]	Plate & Sheet	81Cu-9.1Al-4.4Ni-3.9Fe-1.6Mn
35	ASTM	B 171	Aluminum Bronze	C63200	>3.5 ≤5.0 [>89 ≤125]	80/30 [552/207]	Plate & Sheet	81Cu-9.1Al-4.4Ni-3.9Fe-1.6Mn
35	ASTM	B 271	Grade A, Al-Bronze	C95200	—	65/25 [448/172]	Centrifugal Castings	88Cu-9Al-3Fe
35	ASTM	B 271	Grade B, Al-Bronze	C95300	—	65/25 [448/172]	Centrifugal Castings	89Cu-10Al-1Fe
35	ASTM	B 271	Grade C, Al-Bronze	C95400	—	75/30 [517/207]	Centrifugal Castings	85Cu-11Al-4Fe

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Copper and Copper Base Alloys								
35	ASTM	B 271	Aluminum Bronze	C95410	—	75/30 [517/207]	Centrifugal Castings	83Cu-10.7Al-4Fe-2Ni
35	ASTM	B 271	Grade D, Ni-Al Bronze	C95500	—	90/40 [621/276]	Centrifugal Castings	85Cu-11Al-4Fe-3Mn
35	ASTM	B 283	Al-Si Bronze	C64200	≤1.5 [38]	70/25 [483/172]	Die Forgings	89Cu-7Al-1.8Si
35	ASTM	B 283	Al-Si Bronze	C64200	>1.5 [38]	68/23 [469/159]	Die Forgings	89Cu-7Al-1.8Si
35	ASTM	B 315	Aluminum Bronze	C61300	—	65/28 [448/193]	Seamless Pipe	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 315	Aluminum Bronze D	C61400	—	65/28 [448/193]	Seamless Pipe	90Cu-7Al-2.5Fe
35	ASTM	B 359	Aluminum Bronze	C60800	—	50/19 [345/131]	Seamless Tube	93.5Cu-5.8Al-0.27As
35	ASTM	B 395	Aluminum Bronze	C60800	—	50/19 [345/131]	Seamless Tube	93.5Cu-5.8Al-0.27As
35	ASTM	B 505	Grade A, Al-Bronze	C95200	20% of t	68/— [469/—]	Continuous Casting Repair	80Cu-9Al-3Fe
35	ASTM	B 608	Aluminum Bronze	C61300	—	70/— [483/—]	Welded Pipe	90Cu-6.8Al-2.5Fe-0.35Sn
35	ASTM	B 608	Aluminum Bronze D	C61400	—	70/— [483/—]	Welded Pipe	90Cu-7Al-2.5Fe

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
41	ASTM	B 160	99.0 min. Ni (Alloy 200)	N02200	—	55/15 [379/103]	Rod & Bar	99.0min.Ni
41	ASTM	B 160	Low-C 99 min. Ni (Alloy 201)	N02201	—	50/10 [345/69]	Rod & Bar	LoC-99min.Ni
41	ASTM	B 161	99.0 min. Ni (Alloy 200)	N02200	≤5 [125] O.D.	55/15 [379/103]	Seamless Pipe & Tube	99.0min.Ni
41	ASTM	B 161	99.0 min. Ni (Alloy 200)	N02200	>5 [125] O.D.	55/12 [379/83]	Seamless Pipe & Tube	99.0min.Ni
41	ASTM	B 161	Low-C 99 min. Ni (Alloy 201)	N02201	≤5 [125] O.D.	50/12 [345/83]	Seamless Pipe & Tube	LoC-99min.Ni
41	ASTM	B 161	Low-C 99 min. Ni (Alloy 201)	N02201	>5 [125] O.D.	50/10 [345/69]	Seamless Pipe & Tube	LoC-99min.Ni
41	ASTM	B 162	99.0 min. Ni (Alloy 200)	N02200	—	55/15 [379/103]	Sheet, Strip & Plate	99.0min.Ni
41	ASTM	B 162	Low-C 99 min. Ni (Alloy 201)	N02201	—	50/12 [345/83]	Sheet, Strip & Plate	LoC-99min.Ni
41	ASTM	B 163	99.0 min. Ni (Alloy 200)	N02200	—	55/15 [379/103]	Seamless Tube	99.0min.Ni
41	ASTM	B 163	Low-C 99 min. Ni (Alloy 201)	N02201	—	50/12 [345/83]	Seamless Tube	LoC-99min.Ni
41	ASTM	B 366	CRN/WPN	N02200	—	55/15 [379/103]	Fittings	99.0min.Ni
41	ASTM	B 366	CRNL/WPNL	N02201	—	50/10 [345/69]	Fittings	LoC-99min.Ni
41	ASTM	B 564	Alloy 200	N02200	—	55/15 [379/103]	Forgings	99.0min.Ni
42	ASTM	A 494	Grade M-35-2 (Ni-30 Cu)	N04020	—	65/30 [448/207]	Castings	67Ni-31Cu
42	ASTM	A 494	Grade M-30-C	N24130	—	65/32 [448/221]	Castings	66Ni-30Cu-2Cb
42	ASTM	A 494	Grade M-35-1	N24135	—	65/25 [448/172]	Castings	67Ni-3Cu
42	ASTM	B 127	Ni-Cu (30) (Alloy 400)	N04400	—	70/28 [483/193]	Sheet, Strip & Plate	67Ni-31Cu
42	ASTM	B 163	Ni-Cu (30) (Alloy 400)	N04400	—	70/28 [483/193]	Seamless Tube	67Ni-31Cu
42	ASTM	B 164	Ni-Cu (30) (Alloy 400)	N04400	—	70/25 [483/172]	Rod, Bar & Wire	67Ni-31Cu
42	ASTM	B 164	Ni-Cu (30) (Alloy R 405)	N04405	—	70/25 [483/172]	Rod, Bar & Wire	67Ni-30Cu-S
42	ASTM	B 165	Ni-30Cu (Alloy 400)	N04400	≤5 [125] O.D.	70/28 [483/193]	Seamless Pipe & Tube	67Ni-31Cu
42	ASTM	B 165	Ni-30Cu (Alloy 400)	N04400	>5 [125] O.D.	70/25 [483/172]	Seamless Pipe & Tube	67Ni-31Cu
42	ASTM	B 366	CRNC/WPNC	N04400	—	70/25 [483/172]	Fittings	67Ni-31Cu
42	ASTM	B 564	Alloy 400	N04400	—	70/25 [483/172]	Forgings	67N-31Cu

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
43	ASTM	A 494	Grade CY-40	N06040	—	70/28 [483/193]	Castings	77Ni-15.5Cr-Fe
43	ASTM	A 494	Grade CX2MW	N26022	—	80/45 [552/310]	Castings	57Ni-21Cr-13Mo-4Fe-3W
43	ASTM	A 494	Grade CW2M	N26455	—	72/40 [496/276]	Castings	65.6Ni-16.2Cr-16.2Mo
43	ASTM	A 494	Grade CW-6 MC	N26625	—	70/40 [483/276]	Castings	62Ni-21.5Cr-9Mo-4Cb
43	ASTM	A 494	Grade CW-6M	N30107	—	72/40 [496/276]	Castings	61Ni-18.5Cr-18.5Mo-Fe
43	ASTM	B 163	Ni-Cr-Fe (Alloy 6025HT)	N06025	—	98/39 [676/269]	Seamless Tube	62.5Ni-25Cr-9.5Fe-2.1Al
43	ASTM	B 163	Ni-Cr-Fe (Alloy 600)	N06600	—	80/35 [552/241]	Seamless Tube	72Ni-15Cr-8Fe
43	ASTM	B 163	Ni-Cr-Fe (Alloy 690)	N06690	—	85/35 [586/241]	Seamless Tube	58Ni-29Cr-9Fe
43	ASTM	B 166	Ni-Cr-Fe (Alloy 6025 HT)	N06025	—	98/39 [676/269]	Rod & Bar	62.5Ni-25Cr-9.5Fe-2.1Al
43	ASTM	B 166	Ni-Cr-Fe (Alloy 600)	N06600	—	80/35 [552/241]	Rod & Bar	72Ni-15Cr-8Fe
43	ASTM	B 166	Ni-Cr-Fe (Alloy 601)	N06601	—	80/30 [552/207]	Rod & Bar	60Ni-23Cr-12Fe-Al
43	ASTM	B 166	Ni-Cr-Co-Mo (Alloy 617)	N06617	—	95/35 [655/241]	Rod & Bar	54Ni-22Cr-12Co-9Mo
43	ASTM	B 166	Ni-Cr-Fe (Alloy 690)	N06690	—	85/35 [586/241]	Rod & Bar	58Ni-29Cr-9Fe
43	ASTM	B 167	Ni-Cr-Fe (Alloy 6025HT)	N06025	—	98/39 [676/269]	Seamless Pipe & Tube	62.5Ni-25Cr-9.5Fe-2.1Al
43	ASTM	B 167	Ni-Cr-Fe (Alloy 600)	N06600	0.405 ≤ 5 [10.29 ≤ 125] O.D.	80/30 [552/207]	Seamless Pipe & Tube	75Ni-15Cr-8Fe
43	ASTM	B 167	Ni-Cr-Fe (Alloy 600)	N06600	>5.0 ≤ 9.25 [125 ≤ 235] O.D.	75/25 [517/172]	Seamless Pipe & Tube	75Ni-15Cr-8Fe
43	ASTM	B 167	Ni-Cr-Fe (Alloy 601)	N06601	0.405 ≤ 9.25 [10.29 ≤ 235] O.D.	80/30 [552/207]	Seamless Pipe & Tube	60Ni-23Cr-12Fe-Al
43	ASTM	B 167	Ni-Cr-Fe (Alloy 690)	N06690	0.405 ≤ 5 [10.29 ≤ 125] O.D.	85/30 [586/207]	Seamless Pipe & Tube	58Ni-29Cr-9Fe
43	ASTM	B 167	Ni-Cr-Fe (Alloy 690)	N06690	>5.0 ≤ 9.25 [125 ≤ 235] O.D.	75/25 [517/172]	Seamless Pipe & Tube	58Ni-29Cr-9Fe
43	ASTM	B 168	Alloy 6025 HT	N06025	—	98/39 [676/269]	Sheet, Strip & Plate	62.5Ni-25Cr-9.5Fe-2.1Al
43	ASTM	B 168	Alloy 600	N06600	—	80/35 [552/241]	Sheet, Strip & Plate	75Ni-15Cr-8Fe
43	ASTM	B 168	Alloy 601	N06601	—	80/30 [552/207]	Plate, Sheet & Strip	60Ni-23Cr-12Fe-Al
43	ASTM	B 168	Alloy 617	N06617	—	95/35 [655/241]	Plate, Sheet & Strip	54Ni-22Cr-12Co-9Mo
43	ASTM	B 168	Alloy 690	N06690	—	85/35 [586/241]	Plate, Sheet & Strip	58Ni-29Cr-9Fe
43	ASTM	B 366	CRHX/WPHX	N06002	—	100/— [689/—]	Fittings	47Ni-22Cr-18Fe-9Mo

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
43	ASTM	B 366	CRHG/WPHG	N06007	—	90/— [621/—]	Fittings	47Ni-22Cr-19Fe-6Mo
43	ASTM	B 366	CRHC22/WPHC22	N06022	—	100/45 [689/310]	Fittings	55Ni-21Cr-13.5Mo
43	ASTM	B 366	CRV602/WPV602	N06025	—	98/39 [676/269]	Fittings	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 366	CRHG30/WPHG30	N06030	—	85/35 [586/241]	Fittings	40Ni-29Cr-15Fe-5Mo
43	ASTM	B 366	CR5923/WP5923	N06059	—	85/35 [586/241]	Fittings	59Ni-23Cr-16Mo
43	ASTM	B 366	CRHC2000/WPHC2000	N06200	—	100/41 [689/283]	Fittings	58Ni-23Cr-16Mo-1.6Cu
43	ASTM	B 366	CRM21/WPM21	N06210	—	100/45 [689/310]	Fittings	59Ni-19Cr-19Mo-1.8Ta
43	ASTM	B 366	CRH230/WPH230	N06230	—	110/45 [758/310]	Fittings	56Ni-22Cr-14W-2Mb
43	ASTM	B 366	CRHC4/WPHC4	N06455	—	100/40 [689/276]	Fittings	65Ni-10Cr-15.5Mo
43	ASTM	B 366	CRNCI/WPNCI	N06600	—	80/— [552/—]	Fittings	75Ni-15Cr-8Fe
43	ASTM	B 366	CR603GT/WP603GT	N06603	—	94/43 [648/296]	Fittings	62Ni-25Cr-9Fe-2.7Al
43	ASTM	B 366	CRNCMC/WPNCMC	N06625	—	110/— [758/—]	Fittings	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 366	CRHG3/WPHG3	N06985	—	90/— [621/—]	Fittings	47Ni-22Cr-20Fe-7Mn
43	ASTM	B 366	CRHC276/WPHC276	N10276	—	100/41 [689/283]	Fittings	54Ni-16Mo-15Cr-5.5Fe-3.8W
43	ASTM	B 435	Alloy X	N06002	—	95/35 [655/241]	Plate, Sheet & Strip	47Ni-22Cr-18Fe-9Mo
43	ASTM	B 435	Alloy 230	N06230	—	110/45 [758/310]	Plate, Sheet & Strip	53Ni-22Cr-14W-2Mo
43	ASTM	B 443	Alloy 625, Grade 1	N06625	—	120/60 [827/414]	Cold Rolled Strip & Sheet	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 443	Alloy 625, Grade 2	N06625	—	110/55 [758/379]	Plate & Hot Rolled Sheet (Sol. Anneal)	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 444	Alloy 625, Grade 1	N06625	—	120/60 [827/414]	Pipe & Tube	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 444	Alloy 625, Grade 2	N06625	—	100/40 [689/276]	Pipe & Tube	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 446	Alloy 625, Grade 1	N06625	≤4 [100]	120/60 [827/414]	Rod & Bar	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 446	Alloy 625, Grade 1	N06625	>4 ≤10 [>100 ≤250]	110/50 [758/345]	Rod & Bar	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 446	Alloy 625, Grade 2	N06625	—	110/40 [758/276]	Rod & Bar	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 516	Alloy 6025 HT	N06025	—	98/39 [676/269]	Welded Tube	62.5Ni-25Cr-9.5Fe-2.1Al
43	ASTM	B 516	Alloy 600	N06600	—	80/35 [552/241]	Welded Tube	75Ni-15Cr-8Fe
43	ASTM	B 516	Alloy 603 GT	N06603	—	94/43 [648/296]	Welded Tube	62Ni-25Cr-9Fe-2.7Al
43	ASTM	B 517	Alloy 6025 HT	N06025	—	98/39 [676/269]	Welded Pipe	62.5Ni-25Cr-9.5Fe-2.1Al

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
43	ASTM	B 517	Alloy 600	N06600	—	80/35 [552/241]	Welded Pipe	75Ni-15Cr-8Fe
43	ASTM	B 517	Alloy 603GT	N06603	—	94/43 [648/296]	Welded Pipe	62Ni-25Cr-9Fe-2.7Al
43	ASTM	B 564	Alloy C-22	N06022	—	100/45 [689/310]	Forgings	56Ni-21Cr-13.5Mo
43	ASTM	B 564	Alloy 6025 HT	N06025	≤4 [100]	98/39 [676/269]	Forgings	62.5Ni-25Cr-9.5Fe-2.1Al
43	ASTM	B 564	Alloy 6025 HT	N06025	>4 [100]	84/39 [579/269]	Forgings	62.5Ni-25Cr-9.5Fe-2.1Al
43	ASTM	B 564	Alloy 59	N06059	—	100/45 [689/310]	Forgings	59Ni-23Cr-16Mo
43	ASTM	B 564	Ni-Cr-Mo-W	N06110	≤4 [100]	95/45 [655/310]	Forgings	51Ni-31Cr-10Mo-W
43	ASTM	B 564	Ni-Cr-Mo-W	N06110	>4.0 [100]	90/40 [621/276]	Forgings	51Ni-31Cr-10Mo-W
43	ASTM	B 564	Alloy C2000	N06200	—	100/41 [689/283]	Forgings	53Ni-23Cr-16Mo-1.6Cu
43	ASTM	B 564	Alloy 21	N06210	—	100/45 [689/310]	Forgings	60Ni-19Cr-19Mo-1.8Ta
43	ASTM	B 564	Alloy 230	N06230	—	110/45 [758/310]	Forgings	53Ni-22Cr-14W-2Mo
43	ASTM	B 564	Alloy 600	N06600	—	80/35 [552/241]	Forgings	75Ni-15Cr-8Fe
43	ASTM	B 564	Alloy 603GT	N06603	—	94/43 [648/296]	Forgings	62Ni-25Cr-9Fe-2.7Al
43	ASTM	B 564	Alloy 617	N06617	—	95/35 [655/241]	Forgings	54Ni-22Cr-12Co-9Mo
43	ASTM	B 564	Alloy 625	N06625	≤4 [100]	120/60 [827/414]	Forgings	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 564	Alloy 625	N06625	>4.0 [100]	110/50 [758/345]	Forgings	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 564	Alloy 686	N06686	—	100/45 [689/310]	Forgings	58Ni-21Cr-16Mo-3.7W
43	ASTM	B 564	Alloy 690	N06690	—	85/35 [586/241]	Forgings	58Ni-29Cr-9Fe
43	ASTM	B 564	Alloy C-276	N10276	—	100/41 [689/283]	Forgings	54Ni-16Mo-15Cr-5.5Fe-3.8W
43	ASTM	B 564	Alloy CRB10	N10624	—	104/46 [717/317]	Forgings	65Ni-22.5Mo-6.5Fe-6Cr
43	ASTM	B 572	Alloy 230	N06230	—	110/45 [758/310]	Rod	56Ni-22Cr-14W-2Mo
43	ASTM	B 572	Alloy X	N06002	—	95/35 [655/241]	Rod	47Ni-22Cr-18Fe-9Mo
43	ASTM	B 574	Alloy C22	N06022	—	100/45 [689/310]	Rod	56Ni-21Cr-13.5Mo
43	ASTM	B 574	Alloy 59	N06059	—	100/45 [689/310]	Rod	59Ni-23Cr-16Mo
43	ASTM	B 574	Alloy C2000	N06200	—	100/41 [689/283]	Rod	53Ni-23Cr-16Mo-1.6Cu
43	ASTM	B 574	Alloy C-4	N06455	—	100/40 [689/276]	Rod	61Ni-16Mo-16Cr
43	ASTM	B 574	Alloy C686	N06686	—	100/45 [689/310]	Rod	58Ni-21Cr-16Mo-3.5W
43	ASTM	B 574	Alloy C-276	N10276	—	100/41 [689/283]	Rod	54Ni-16Mo-15Cr-5.5Fe-3.8W
43	ASTM	B 575	Alloy C22	N06022	—	100/45 [689/310]	Plate, Sheet & Strip	56Ni-21Cr-13.5Mo

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
43	ASTM	B 575	Alloy 59	N06059	—	100/45 [689/310]	Plate, Sheet & Strip	59Ni-23Cr-16Mo
43	ASTM	B 575	Alloy C2000	N06200	—	100/41 [689/283]	Plate, Sheet & Strip	53Ni-23Cr-16Mo-1.6Cu
43	ASTM	B 575	Alloy C-4	N06455	—	100/40 [689/276]	Plate, Sheet & Strip	61Ni-16Mo-16Cr
43	ASTM	B 575	Alloy 686	N06686	—	100/45 [689/310]	Plate, Sheet & Strip	58Ni-21Cr-16Mo-3.5W
43	ASTM	B 575	Alloy C-276	N10276	—	100/41 [689/283]	Plate, Sheet & Strip	54Ni-16Mo-15Cr-5.5Fe-3.8W
43	ASTM	B 581	Alloy G	N06007	5/16 ≤ 3/4 [8 ≤ 19]	90/35 [621/241]	Rod	47Ni-22Cr-19Fe-6Mo
43	ASTM	B 581	Alloy G	N06007	>3/4 ≤ 3.5 [>19 ≤ 89]	85/30 [586/207]	Rod	47Ni-22Cr-19Fe-6Mo
43	ASTM	B 581	Alloy G-30	N06030	—	85/35 [586/241]	Rod	40Ni-29Cr-15Fe-5Mo
43	ASTM	B 581	Alloy G-2	N06975	—	85/32 [586/221]	Rod	49Ni-25Cr-18Fe-6Mo
43	ASTM	B 581	Alloy G-3	N06985	5/16 ≤ 3/4 [8 ≤ 19]	90/35 [621/241]	Rod	47Ni-22Cr-18Fe-6Mo
43	ASTM	B 581	Alloy G-3	N06985	>3/4 ≤ 3.5 [>19 ≤ 89]	85/30 [586/207]	Rod	47Ni-22Cr-18Fe-6Mo
43	ASTM	B 582	Alloy G	N06007	0.20 ≤ 3/4 [5 ≤ 19]	90/35 [621/241]	Plate, Sheet & Strip	47Ni-22Cr-19Fe-6Mo
43	ASTM	B 582	Alloy G	N06007	>3/4 ≤ 2.5 [>19 ≤ 64]	85/30 [586/207]	Plate	47Ni-22Cr-19Fe-6Mo
43	ASTM	B 582	Alloy G-30	N06030	—	85/35 [586/241]	Plate, Sheet & Strip	40Ni-29Cr-15Fe-5Mo
43	ASTM	B 582	Alloy G-2	N06975	—	85/32 [586/221]	Plate, Sheet & Strip	49Ni-25Cr-18Fe-6Mo
43	ASTM	B 582	Alloy G-3	N06985	0.20 ≤ 3/4 [5 ≤ 19]	90/35 [621/241]	Plate, Sheet & Strip	47Ni-22Cr-20Fe-7Mo
43	ASTM	B 582	Alloy G-3	N06985	>3/4 ≤ 2.5 [>19 ≤ 64]	85/30 [586/207]	Plate	47Ni-22Cr-20Fe-7Mo
43	ASTM	B 619	Alloy X	N06002	—	100/40 [689/276]	Welded Pipe	47Ni-22Cr-18Fe-9Mo
43	ASTM	B 619	Alloy G	N06007	—	90/35 [621/241]	Welded Pipe	47Ni-22Cr-19Fe-6Mo
43	ASTM	B 619	Alloy C-22	N06022	—	100/45 [689/310]	Welded Pipe	56Ni-21Cr-13.5Mo
43	ASTM	B 619	Alloy G-30	N06030	—	85/35 [586/241]	Welded Pipe	40Ni-29Cr-15Fe-5Mo
43	ASTM	B 619	Alloy 59	N06059	—	100/45 [689/310]	Welded Pipe	59Ni-23Cr-16Mo
43	ASTM	B 619	Alloy C2000	N06200	—	100/41 [689/283]	Welded Tube	53Ni-23Cr-16Mo-1.6Cu
43	ASTM	B 619	Alloy 230	N06230	—	110/45 [758/310]	Welded Pipe	53Ni-22Cr-14W-2Mo
43	ASTM	B 619	Alloy C-4	N06455	—	100/40 [689/276]	Welded Pipe	61Ni-16Mo-16Cr

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
43	ASTM	B 619	Alloy 686	N06686	—	100/45 [689/310]	Welded Pipe	58Ni-21Cr-16Mo-3.5W
43	ASTM	B 619	Alloy G-2	N06975	—	85/32 [586/221]	Welded Pipe	49Ni-25Cr-18Fe-6Mo
43	ASTM	B 619	Alloy G-3	N06985	—	90/35 [621/241]	Welded Pipe	47Ni-22Cr-20Fe-7Mo
43	ASTM	B 619	Alloy C-276	N10276	—	100/41 [689/283]	Welded Pipe	54Ni-16Mo-15Cr-5.5Fe-3.8W
43	ASTM	B 622	Alloy X	N06002	—	100/40 [689/276]	Seamless Pipe & Tube	47Ni-22Cr-18Fe-9Mo
43	ASTM	B 622	Alloy G	N06007	—	90/35 [621/241]	Seamless Pipe & Tube	47Ni-22Cr-19Fe-6Mo
43	ASTM	B 622	Alloy C-22	N06022	—	100/45 [689/310]	Seamless Pipe & Tube	56Ni-21Cr-13.5Mo
43	ASTM	B 622	Alloy G-30	N06030	—	85/35 [586/241]	Seamless Pipe & Tube	40Ni-29Cr-15Fe-5Mo
43	ASTM	B 622	Alloy 59	N06059	—	100/45 [689/310]	Seamless Pipe & Tube	59Ni-23Cr-16Mo
43	ASTM	B 622	Alloy 2060 Mo	N06060	—	90/35 [621/241]	Seamless Pipe & Tube	57Ni-20.5Cr-13Mo-6Fe
43	ASTM	B 622	Alloy C2000	N06200	—	100/41 [689/283]	Seamless Pipe & Tube	53Ni-23Cr-16Mo-1.6Cu
43	ASTM	B 622	Alloy 230	N06230	—	110/45 [758/310]	Seamless Pipe & Tube	53Ni-22Cr-14W-2Mo
43	ASTM	B 622	Alloy 2050	N06250	—	90/35 [621/241]	Seamless Pipe & Tube	52Ni-21Cr-13Fe-11Mo
43	ASTM	B 622	Alloy 2550	N06255	—	85/32 [586/221]	Seamless Pipe & Tube	49.5Ni-24Cr-17Fe-7Mo
43	ASTM	B 622	Alloy 686	N06686	—	100/45 [689/310]	Seamless Pipe & Tube	58Ni-21Cr-16Mo-3.5W
43	ASTM	B 622	Alloy G-2	N06975	—	85/32 [586/221]	Seamless Pipe & Tube	49Ni-25Cr-18Fe-6Mo
43	ASTM	B 622	Alloy G-3	N06985	—	90/35 [621/241]	Seamless Pipe & Tube	47Ni-22Cr-20Fe-7Mo
43	ASTM	B 622	Alloy C-276	N10276	—	100/41 [689/283]	Seamless Pipe & Tube	54Ni-16Mo-15Cr-5.5Fe-3.8W
43	ASTM	B 626	Ni-Cr-Fe-Mo	N06002	—	—	Welded Tube	—
43	ASTM	B 626	Alloy G	N06007	—	90/35 [621/241]	Welded Tube	47Ni-22Cr-19Fe-6Mo
43	ASTM	B 626	Alloy C-22	N06022	—	100/45 [689/310]	Welded Tube	56Ni-21Cr-13.5Mo
43	ASTM	B 626	Alloy G30	N06030	—	85/35 [586/241]	Welded Tube	40Ni-29Cr-15Fe-5Mo
43	ASTM	B 626	Alloy 59	N06059	—	100/45 [689/310]	Welded Tube	59Ni-23Cr-16Mo
43	ASTM	B 626	Alloy C2000	N06200	—	100/41 [689/283]	Welded Tube	53Ni-23Cr-16Mo-1.6Cu
43	ASTM	B 626	Alloy 230	N06230	—	110/45 [758/310]	Welded Tube	59Ni-22Cr-14W-Fe-Mo
43	ASTM	B 626	Alloy C-4	N06455	—	100/40 [689/276]	Welded Tube	65.6Ni-16.2Cr-16.2Mo
43	ASTM	B 626	Alloy 686	N06686	—	100/45 [689/310]	Welded Tube	58Ni-21Cr-16Mo-3.5W
43	ASTM	B 626	Alloy G-2	N06975	—	85/32 [586/221]	Welded Tube	49Ni-25Cr-18Fe-6Mo-Ti
43	ASTM	B 626	Alloy G-3	N06985	—	90/32 [621/221]	Welded Tube	47Ni-22Cr-20Fe-7Mo-2Cu

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
43	ASTM	B 626	Alloy C-276	N10276	—	100/41 [689/283]	Welded Tube	54Ni-16Mo-15Cr-5.5Fe-3.8W
43	ASTM	B 704	Alloy 625	N06625	—	120/60 [827/414]	Welded Tube	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 705	Alloy 625	N06625	—	120/60 [827/414]	Welded Pipe	60Ni-22Cr-9Mo-3.5Cb
43	ASTM	B 755	Ni-Cr-Mo-W	N06110	—	95/45 [655/310]	Plate, Sheet & Strip	51Ni-31Cr-10Mo-2.5W
43	ASTM	B 756	Ni-Cr-Mo-W	N06110	≤4 [100]	95/45 [655/310]	Rod & Bar	51Ni-31Cr-10Mo-2.5W
43	ASTM	B 756	Ni-Cr-Mo-W	N06110	>4.0≤10 [>100 ≤250]	90/40 [621/276]	Rod & Bar	51Ni-31Cr-10Mo-2.5W
43	ASTM	B 757	Ni-Cr-Mo-W	N06110	—	95/45 [655/310]	Welded Pipe	51Ni-31Cr-10Mo-2.5W
43	ASTM	B 758	Ni-Cr-Mo-W	N06110	—	95/45 [655/310]	Welded Tube	51Ni-31Cr-10Mo-2.5W
43	ASTM	B 759	Ni-Cr-Mo-W	N06110	—	95/45 [655/310]	Pipe & Tube	51Ni-31Cr-10Mo-2.5W
44	ASTM	A 494	Grade N7M	J30007	—	76/40 [524/276]	Castings	61Ni-31.5Mo
44	ASTM	B 333	Alloy B (Ni-Mo-Fe)	N10001	≤3/16 [5]	115/50 [793/345]	Sheet & Strip	62Ni-28Mo-5maxFe
44	ASTM	B 333	Alloy B (Ni-Mo-Fe)	N10001	3/16 ≤ 2.5 [5 ≤64]	100/45 [689/310]	Plate	62Ni-28Mo-5maxFe
44	ASTM	B 333		N10624	—	104/46 [717/317]	Plate, Sheet & Strip	60Ni-23Mo-8Cr-6.5Fe
44	ASTM	B 333	Alloy B-4 (Ni-Mo-Fe)	N10629	—	110/51 [758/352]	Plate, Sheet & Strip	62Ni-28Mo-3Fe-1.3Cr-Al
44	ASTM	B 333	Alloy B-2 (Ni-Mo)	N10665	—	110/51 [758/352]	Plate, Sheet & Strip	65Min.Ni-28Mo-2Fe
44	ASTM	B 333	Alloy B-3 (Ni-Mo-Cr-Fe)	N10675	—	110/51 [758/352]	Plate, Sheet & Strip	65Ni-30Mo-2Cr-2Fe
44	ASTM	B 335	Alloy B (Ni-Mo-Fe)	N10001	5/16 ≤1.5 [8 ≤38]	115/46 [793/317]	Rod	62Ni-28Mo-5Max.Fe
44	ASTM	B 335	Alloy B (Ni-Mo-Fe)	N10001	>1.5 ≤2.5 [38 ≤64]	100/45 [689/310]	Rod	62Ni-28Mo-5Max.Fe
44	ASTM	B 335		N10624	—	104/46 [717/317]	Rod	60Ni-23Mo-8Cr-6.5Fe
44	ASTM	B 335	Alloy B-4 (Ni-Mo-Fe)	N10629	—	110/51 [758/352]	Rod	62Ni-28Mo-3Fe-1.3Cr-Al
44	ASTM	B 335	Alloy B-2 (Ni-Mo)	N10665	—	110/51 [758/352]	Rod	65Min.Ni-28Mo-2Fe-2C
44	ASTM	B 335	Alloy B-3 (Ni-Mo-Cr-Fe)	N10675	—	110/51 [758/352]	Rod	65Ni-30Mo-2Cr-2Fe
44	ASTM	B 366	CRHB/WPHB	N10001	—	100/45 [689/310]	Fittings	62Ni-28Mo-5maxFe
44	ASTM	B 366	CRHN/WPHN	N10003	—	100/— [689/—]	Fittings	70Ni-16Mo-7Cr-5Fe
44	ASTM	B 366	CRB10/WPB10	N10624	—	104/46 [717/317]	Fittings	60Ni-23Mo-8Cr-6.5Fe
44	ASTM	B 366	CRVB4/WPVB4	N10629	—	110/51 [758/352]	Fittings	62Ni-28Mo-3Fe-1.3Cr-Al

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
44	ASTM	B 366	CRHB2/WPHB2	N10665	—	100/— [689/—]	Fittings	65Ni-28Mo-2Max.Fe
44	ASTM	B 366	CRHB3/WPHB3	N10675	—	110/51 [758/352]	Fittings	65Min.Ni-29.5Mo-2Cr-2Fe
44	ASTM	B 434	Alloy N	N10003	—	100/40 [689/276]	Plate, Sheet & Strip	70Ni-16Mo-7Cr-5Fe
44	ASTM	B 564	Alloy B-10	N10624	—	104/46 [717/317]	Forgings	60Ni-23Mo-8Cr-6.5Fe
44	ASTM	B 564	Alloy B-4 (Ni-Mo-Fe)	N10629	—	110/51 [758/352]	Forgings	62Ni-28Mo-3.5Fe-1Cr
44	ASTM	B 564	Alloy B-3	N10675	—	110/51 [758/352]	Forgings	65Min.Ni-29.5Mo-2Cr-2Fe
44	ASTM	B 573	Alloy N	N10003	—	100/40 [689/276]	Rod	70Ni-16Mo-7Cr-5Fe
44	ASTM	B 619	Alloy B	N10001	—	100/45 [689/310]	Welded Pipe	62Ni-28Mo-5maxFe
44	ASTM	B 619	Alloy B-10	N10624	—	104/46 [717/317]	Welded Pipe	60Ni-23Mo-8Cr-6.5Fe
44	ASTM	B 619	Alloy B-4	N10629	—	110/51 [758/352]	Welded Pipe	62Ni-28Mo-3.5Fe-1Cr
44	ASTM	B 619	Alloy B-2	N10665	—	110/51 [758/352]	Welded Pipe	65Ni-28Mo-2Max.Fe
44	ASTM	B 619	Alloy B-3	N10675	—	110/51 [758/352]	Welded Pipe	65Min.Ni-29.5Mo-2Cr-2Fe
44	ASTM	B 622	Alloy B	N10001	—	100/45 [689/310]	Seamless Pipe & Tube	62Ni-28Mo-2Max.Fe
44	ASTM	B 622	Alloy B-10	N10624	—	104/46 [717/317]	Seamless Pipe & Tube	60Ni-23Mo-8Cr-6.5Fe
44	ASTM	B 622	Alloy B-4	N10629	—	110/51 [758/352]	Seamless Pipe & Tube	62Ni-28Mo-3.5Fe-1Cr
44	ASTM	B 622	Alloy B-2	N10665	—	110/51 [758/352]	Seamless Pipe & Tube	65Ni-28Mo-2Max.Fe
44	ASTM	B 622	Alloy B-3	N10675	—	110/51 [758/352]	Seamless Pipe & Tube	65Min.Ni-29.5Mo-2Cr-2Fe
44	ASTM	B 626	Alloy B	N10001	—	100/45 [689/310]	Welded Tube	62Ni-28Mo-5maxFe
44	ASTM	B 626	Alloy B-10	N10624	—	104/46 [717/317]	Welded Tube	60Ni-23Mo-8Cr-6.5Fe
44	ASTM	B 626	Alloy B-4	N10629	—	110/51 [758/352]	Welded Tube	62Ni-28Mo-3.5Fe-1Cr
44	ASTM	B 626	Alloy B-2	N10665	—	110/51 [758/352]	Welded Tube	65Ni-28Mo-2Max.Fe
44	ASTM	B 626	Alloy B-3	N10675	—	110/51 [758/352]	Welded Tube	65Min.Ni-29.5Mo-2Cr-2Fe
45	ASTM	A 351	CN7M	N08007	—	62/25 [427/172]	Castings	43Fe-28Ni-19Cr-Cu-Mn
45	ASTM	A 351	CT15C	N08151	—	63/25 [434/172]	Castings	46Fe-32Ni-20Cr-Cb
45	ASTM	B 163	Ni-Fe-Cr (Alloy 800)	N08800	—	75/30 [517/207]	Seamless Tube	44Fe-33Ni-21Cr
45	ASTM	B 163	Ni-Fe-Cr (Alloy 801)	N08801	—	65/25 [448/172]	Seamless Tube	45Fe-32Ni-20.5Cr-Ti
45	ASTM	B 163	Ni-Fe-Cr (Alloy 800H)	N08810	—	65/25 [448/172]	Seamless Tube	44Fe-33Ni-21Cr
45	ASTM	B 163	Ni-Fe-Cr (Alloy 800HT)	N08811	—	65/25 [448/172]	Seamless Tube	42Fe-33Ni-21Cr-Al-Ti

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
45	ASTM	B 163	Ni-Fe-Cr (Alloy 825)	N08825	—	85/35 [586/241]	Seamless Tube	42Fe-30Ni-21.5Cr-3Mo-2.3Cu
45	ASTM	B 366	CR20CB/WP20CB	N08020	—	80/35 [552/241]	Fittings	36Fe-35Ni-20Cr-4Cu-2Mo
45	ASTM	B 366	CR3127/WP3127	N08031	—	94/40 [648/276]	Fittings	31Ni-31Fe-27Cr-7Mo
45	ASTM	B 366	CRH120/WPH120	N08120	—	90/40 [621/276]	Fittings	37Ni-28Fe-25Cr-3Co-2Mo-2W
45	ASTM	B 366	CR330/WP330	N08330	—	70/30 [483/207]	Fittings	43Fe-35.5Ni-18.5Cr-Si
45	ASTM	B 366	CR6XN/WP6XN	N08367	—	95/45 [655/310]	Fittings	46Fe-24Ni-21Cr-6.5Mo-N
45	ASTM	B 366	CRNIC/WPNIC	N08800	—	75/30 [517/207]	Fittings	44Fe-33Ni-21Cr
45	ASTM	B 366	CRNIC10/WPNIC10	N08810	—	65/25 [448/172]	Fittings	44Fe-32.5Ni-21Cr-Al-Ti
45	ASTM	B 366	CRNIC11/WPNIC11	N08811	—	65/25 [448/172]	Fittings	42Fe-33Ni-21Cr-Al-Ti
45	ASTM	B 366	CRNICMC/WPNICMC	N08825	—	85/35 [586/241]	Fittings	42Fe-22MinNi-21.5Cr-3Mo-2Cu
45	ASTM	B 366	CR904L/WP904L	N08904	—	71/31 [490/214]	Fittings	44Fe-25.5Ni-21Cr-4.5Mo-1.5Cu
45	ASTM	B 366	CR1925/WP1925	N08925	—	87/- [600/-]	Fittings	46Fe-25Ni-20Cr-6.5Mo-1Cu-N
45	ASTM	B 366	CR1925N/WP1925N	N08926	—	87/- [600/-]	Fittings	45Fe-25Ni-20Cr-6.5Mo-1Cu-Mn-N
45	ASTM	B 366	CR3033/WP3033	R20033	—	109/55 [752/379]	Fittings	33Fe-33Cr-31.5Ni-1Mo-1Mn-Cu-N
45	ASTM	B 366	CRH556/WPH556	R30556	—	100/45 [689/310]	Fittings	30Fe-22Cr-21Ni-18.5Co-3Mo-2.7W
45	ASTM	B 407	Alloy HR120	N08120	—	90/40 [621/276]	Seamless Pipe & Tube	37Ni-28Fe-25Cr-3Co-2Mo-2W
45	ASTM	B 407	Alloy 800	N08800	—	75/30 [517/207]	Seamless Pipe & Tube	42Fe-33Ni-21Cr
45	ASTM	B 407	Alloy 801	N08801	—	65/25 [448/172]	Seamless Pipe & Tube	45Fe-32Ni-20.5Cr
45	ASTM	B 407	Alloy 800H	N08810	—	65/25 [448/172]	Seamless Pipe & Tube	47Fe-32Ni-20.5Cr
45	ASTM	B 407	Alloy 800 HT	N08811	—	65/25 [448/172]	Seamless Pipe & Tube	39.5Fe-32.5Ni-21Cr-1Mn-Cb
45	ASTM	B 408	Alloy HR120	N08120	—	90/40 [621/276]	Rod & Bar	37Ni-28Fe-25Cr-3Co-2Mo-2W
45	ASTM	B 408	Alloy 800	N08800	—	75/30 [517/207]	Rod & Bar	42Fe-33Ni-21Cr
45	ASTM	B 408	Alloy 800H	N08810	—	65/25 [448/172]	Rod & Bar	47Fe-32Ni-20.5Cr
45	ASTM	B 408	Alloy 800HT	N08811	—	65/25 [448/172]	Rod & Bar	39.5Fe-32.5Ni-21Cr-1Mn-Cb
45	ASTM	B 409	Alloy HR120	N08120	—	90/40 [621/276]	Plate, Sheet & Strip	37Ni-28Fe-25Cr-3Co-2Mo-2W
45	ASTM	B 409	Alloy 800	N08800	—	75/30 [517/207]	Plate, Sheet & Strip	42Fe-33Ni-21Cr
45	ASTM	B 409	Alloy 810	N08810	—	65/25 [448/172]	Plate, Sheet & Strip	47Fe-32Ni-20.5Cr
45	ASTM	B 409	Alloy 811	N08811	—	65/25 [448/172]	Plate, Sheet & Strip	39.5Fe-32.5Ni-21Cr-1Mn-Cb
45	ASTM	B 423	Alloy 20Cb3Mod.	N08221	—	79/34 [545/234]	Seamless Pipe & Tube	41Ni-30Fe-21Cr-5.7Mo-2Cu

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
45	ASTM	B 423	Alloy 825	N08825	—	75/25 [517/172]	Seamless Pipe & Tube	42Ni-30Fe-21.5Cr-3Mo-2.3Cu
45	ASTM	B 424	Alloy 20Cb3Mod.	N08221	—	79/34 [545/234]	Plate, Sheet & Strip	41Ni-30Fe-21Cr-5.7Mo-2Cu
45	ASTM	B 424	Alloy 825	N08825	—	85/35 [586/241]	Plate, Sheet & Strip	42Ni-30Fe-21.5Cr-3Mo-2.3Cu
45	ASTM	B 425	Alloy 20Cb3Mod.	N08221	—	79/34 [545/234]	Rod & Bar	41Ni-30Fe-21Cr-5.7Mo-2Cu
45	ASTM	B 425	Alloy 825	N08825	—	85/35 [586/241]	Rod & Bar	42Ni-30Fe-21.5Cr-3Mo-2.3Cu
45	ASTM	B 435	Alloy 556	R30556	—	100/45 [689/310]	Plate, Sheet & Strip	30Fe-22Cr-21Ni-18Co-3Mo-2.7W
45	ASTM	B 462	Alloy 20Cb3	N08020	—	80/35 [552/241]	Forged or Rolled Pipe Flanges, etc.	35Ni-35Fe-20Cr-3Cb-2.5Mo
45	ASTM	B 462	Alloy 20Mo-4	N08024	—	80/35 [552/241]	Forged or Rolled Pipe Flanges, etc.	37Ni-33Fe-24Cr-4Mo-2Cu
45	ASTM	B 462	Alloy 20 Mo-6	N08026	—	80/35 [552/241]	Forged or Rolled Pipe Flanges, etc.	35Ni-31Fe-24Cr-6Mo-3Cu
45	ASTM	B 462	Alloy 6XN	N08367	—	95/45 [655/310]	Forged or Rolled Pipe Flanges, etc.	46Fe-24Ni-21Cr-6.5Mo-Cu-N
45	ASTM	B 462	Alloy 33	R20033	—	109/55 [752/379]	Forged or Rolled Pipe Flanges, etc.	33Fe-33Cr-32Ni-Mo-Cu-N
45	ASTM	B 463	Alloy 20Cb3	N08020	—	80/35 [552/241]	Plate, Sheet & Strip	35Ni-35Fe-20Cr-3Cb-2.5Mo
45	ASTM	B 463	Alloy 20Mo-4	N08024	—	80/35 [552/241]	Plate, Sheet & Strip	37Ni-33Fe-24Cr-4Mo-2Cu
45	ASTM	B 463	Alloy 20 Mo-6	N08026	—	80/35 [552/241]	Plate, Sheet & Strip	35Ni-31Fe-24Cr-6Mo-3Cu
45	ASTM	B 464	Alloy 20Cb3	N08020	—	80/35 [552/241]	Welded Pipe	35Ni-35Fe-20Cr-3Cb-2.5Mo
45	ASTM	B 464	Alloy 20Mo-4	N08024	—	80/35 [552/241]	Welded Pipe	37Ni-33Fe-24Cr-4Mo-2Cu
45	ASTM	B 464	Alloy 20 Mo-6	N08026	—	80/35 [552/241]	Welded Pipe	35Ni-31Fe-24Cr-6Mo-3Cu
45	ASTM	B 468	Alloy 20Cb3	N08020	—	80/35 [552/241]	Welded Tube	35Ni-35Fe-20Cr-3Cb-2.5Mo
45	ASTM	B 468	Alloy 20Mo-4	N08024	—	80/35 [552/241]	Welded Tube	37Ni-33Fe-24Cr-4Mo-2Cu
45	ASTM	B 468	Alloy 20 Mo-6	N08026	—	80/35 [552/241]	Welded Tube	35Ni-31Fe-24Cr-6Mo-3Cu
45	ASTM	B 473	Alloy 20Cb3	N08020	—	80/35 [552/241]	Bars	35Ni-35Fe-20Cr-3Cb-2.5Mo
45	ASTM	B 473	Alloy 20Mo-4	N08024	—	80/35 [552/241]	Bars	37Ni-33Fe-24Cr-4Mo-2Cu
45	ASTM	B 473	Alloy 20 Mo-6	N08026	—	80/35 [552/241]	Bars	35Ni-31Fe-24Cr-6Mo-3Cu
45	ASTM	B 511	Alloy 330	N08330	—	70/30 [483/207]	Bars & Shapes	43Fe-35.5Ni-18.5Cr-Si
45	ASTM	B 511	Alloy 330 TX	N08332	—	67/27 [462/186]	Bars & Shapes	42Fe-35.5Ni-18.5Cr-1Si-Ti

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
45	ASTM	B 512	Alloy 330	N08330	—	70/30 [483/207]	Billets & Bars	43Fe-35.5Ni-18.5Cr-1Si
45	ASTM	B 514	Alloy HR120	N08120	—	90/40 [621/276]	Welded Pipe	37Ni-30Fe-25Cr-Co-Mo-Cb
45	ASTM	B 514	Alloy 800	N08800	—	75/30 [517/207]	Welded Pipe	44Fe-33Ni-21Cr
45	ASTM	B 514	Alloy 800H	N08810	—	65/25 [448/172]	Welded Pipe	44Fe-33Ni-21Cr
45	ASTM	B 515	Alloy HR120	N08120	—	90/40 [621/276]	Welded Tube	37Ni-30Fe-25Cr-Co-Mo-Cb
45	ASTM	B 515	Alloy 800	N08800	—	75/30 [517/207]	Welded Tube	44Fe-33Ni-21Cr
45	ASTM	B 515	Alloy 800H	N08810	—	65/25 [448/172]	Welded Tube	44Fe-33Ni-21Cr
45	ASTM	B 515	Alloy 800HT	N08811	—	65/25 [448/172]	Welded Tube	42Fe-33Ni-21Cr-Al-Ti
45	ASTM	B 535	Alloy 330	N08330	—	70/30 [483/207]	Seamless Pipe & Tube	43Fe-35.5Ni-18.5Cr-Si
45	ASTM	B 535	Alloy 330TX	N08332	—	67/27 [462/186]	Seamless Pipe & Tube	42Fe-35.5Ni-18.5Cr-1Si-Ti
45	ASTM	B 536	Alloy 330	N08330	—	70/30 [483/207]	Plate, Sheet & Strip	43Fe-35.5Ni-18.5Cr-Si
45	ASTM	B 536	Alloy 330TX	N08332	—	67/27 [462/186]	Plate, Sheet & Strip	42Fe-35.5Ni-18.5Cr-1Si-Ti
45	ASTM	B 564	Alloy 31	N08031	—	94/40 [648/276]	Forgings	31Ni-31Fe-27Cr-7Mo-Cu
45	ASTM	B 564	Alloy HR120	N08120	—	90/40 [621/276]	Forgings	37Ni-30Fe-25Cr-Mo-Cb
45	ASTM	B 564	Alloy AL-6XXN	N08367	—	95/45 [655/310]	Forgings	46Fe-24Ni-21Cr-6.5Mo
45	ASTM	B 564	Alloy 800	N08800	—	75/30 [517/207]	Forgings	44Fe-33Ni-21Cr
45	ASTM	B 564	Alloy 800H	N08810	—	65/25 [448/172]	Forgings	44Fe-33Ni-21Cr
45	ASTM	B 564	Alloy 800HT	N08811	—	65/25 [448/172]	Forgings	42Fe-33Ni-21Cr-Al-Ti
45	ASTM	B 564	Alloy 825	N08825	—	85/35 [586/241]	Forgings	42Ni-30Fe-21.5Cr-3Mo-2.3Cu
45	ASTM	B 564	Alloy 33	R20033	—	109/55 [752/379]	Forgings	33Fe-33Cr-32Ni-Mo-Cu-N
45	ASTM	B 572	Fe-Cr-Ni-Co-Mo-W (Alloy 556)	R30556	—	100/45 [689/310]	Rod	33Fe-22Cr-21Ni-18Co-3Mo-3W
45	ASTM	B 599	Alloy 700	N08700	—	80/35 [552/241]	Plate, Sheet & Strip	47Fe-25Ni-21Cr-5Mo
45	ASTM	B 619	Alloy 31	N08031	—	94/40 [648/276]	Welded Pipe	31Fe-31Ni-27Cr-7Mo-Cu
45	ASTM	B 619	Alloy 20 Mod.	N08320	—	75/28 [517/193]	Welded Pipe	43Fe-26Ni-22Cr-5Mo
45	ASTM	B 619	Alloy 33	R20033	—	109/55 [752/379]	Welded Pipe	33Fe-33Cr-32Ni-Mo-Cu-N
45	ASTM	B 619	Alloy 556	R30556	—	100/45 [689/310]	Welded Pipe	30Fe-22Cr-21Ni-18Co-3Mo-2.7W
45	ASTM	B 620	Alloy 20 Mod.	N08320	—	75/28 [517/193]	Plate, Sheet & Strip	43Fe-26Ni-22Cr-5Mo
45	ASTM	B 621	Alloy 20 Mod.	N08320	—	75/28 [517/193]	Rod	43Fe-26Ni-22Cr-5Mo

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
45	ASTM	B 622	Alloy 31	N08031	—	94/40 [648/276]	Seamless Pipe & Tube	31Fe-31Ni-27Cr-7Mo-Cu
45	ASTM	B 622	Alloy 2035	N08135	—	73/31 [503/214]	Seamless Pipe & Tube	36Ni-35Fe-22Cr-4.5Mo
45	ASTM	B 622	Alloy 20 Mod.	N08320	—	75/28 [517/193]	Seamless Pipe & Tube	43Fe-26Ni-22Cr-5Mo
45	ASTM	B 622	Fe-Ni-Cr-Mo-Cu	N08535	—	73/31 [503/214]	Seamless Pipe & Tube	37Fe-33Ni-25.5Cr-3.2Mo-Cu
45	ASTM	B 622	Alloy 33	R20033	—	109/55 [752/379]	Seamless Pipe & Tube	33Fe-33Cr-32Ni-Mo-Cu-N
45	ASTM	B 622	Alloy 556	R30556	—	100/45 [689/310]	Seamless Pipe & Tube	30Fe-22Cr-21Ni-18Co-3Mo-2.7W
45	ASTM	B 625	Alloy 31	N08031	—	94/40 [648/276]	Plate, Sheet & Strip	31Fe-31Ni-27Cr-7Mo-Cu
45	ASTM	B 625	Alloy 904L	N08904	—	71/31 [490/214]	Plate, Sheet & Strip	44Fe-25Ni-21Cr-4.5Mo
45	ASTM	B 625	Alloy 1925	N08925	—	87/43 [600/296]	Plate, Sheet & Strip	44Fe-25Ni-20Cr-6.5Mo-Cu-N
45	ASTM	B 625	Alloy 926	N08926	—	94/43 [648/296]	Plate, Sheet & Strip	44Fe-25Ni-20Cr-6.5Mo-Cu-N
45	ASTM	B 625	Alloy UR-SB-8	N08932	—	87/44 [600/303]	Plate, Sheet & Strip	41Fe-25Ni-25Cr-5.5Mo-Cu-N
45	ASTM	B 625	Alloy 33	R20033	—	109/55 [752/379]	Plate, Sheet & Strip	33Fe-33Cr-32Ni-Mo-Cu-N
45	ASTM	B 626	Alloy 33	R20033	—	109/55 [752/379]	Welded Tube	33Fe-33Cr-32Ni-Mo-Cu-N
45	ASTM	B 626	Alloy 556	R30556	—	100/45 [689/310]	Welded Tube	30Fe-22Cr-21Ni-18Co-3Mo-2.7W
45	ASTM	B 626	Alloy 31	N08031	—	94/40 [648/276]	Welded Tube	31Fe-31Ni-27Cr-7Mo-Cu
45	ASTM	B 626	Alloy 20 Mod.	N08320	—	75/28 [517/193]	Welded Tube	43Fe-26Ni-22Cr-5Mo
45	ASTM	B 649	Alloy 31	N08031	—	94/40 [648/276]	Bar & Wire	31Fe-31Ni-27Cr-7Mo-Cu
45	ASTM	B 649	Alloy 904L	N08904	—	71/31 [490/214]	Bar & Wire	44Fe-25Ni-21Cr-4.5Mo
45	ASTM	B 649	Alloy 1925	N08925	—	87/43 [600/296]	Bar & Wire	44Fe-25Ni-20Cr-6Mo-Cu-N
45	ASTM	B 649	Alloy 926	N08926	—	94/43 [648/296]	Bar & Wire	44Fe-25Ni-20Cr-6.5Mo-Cu-N
45	ASTM	B 649	Alloy 33	R20033	—	109/55 [752/379]	Bar & Wire	33Fe-33Cr-31.5Ni-Mo-Cu-N
45	ASTM	B 668	Alloy 28	N08028	—	73/31 [503/214]	Seamless Tube	31Ni-31Fe-29Cr-Mo
45	ASTM	B 672	Alloy 700	N08700	—	80/35 [552/241]	Bar	47Fe-25Ni-21Cr-5Mo-Cb
45	ASTM	B 673	Alloy 904L	N08904	—	71/31 [490/214]	Welded Pipe	44Fe-25Ni-21Cr-4.5Mo-Cu
45	ASTM	B 673	Alloy 1925	N08925	—	87/43 [600/296]	Welded Pipe	46Fe-25Ni-20Cr-6Mo-Cu-N
45	ASTM	B 673	Alloy 926	N08926	—	94/43 [648/296]	Welded Pipe	35Ni-31Fe-24Cr-6Mo-3Cu
45	ASTM	B 674	Alloy 904L	N08904	—	71/31 [490/214]	Welded Pipe	44Fe-25Ni-21Cr-4.5Mo-Cu
45	ASTM	B 674	Alloy 1925	N08925	—	87/43 [600/296]	Welded Tube	46Fe-25Ni-20Cr-6Mo-Cu-N
45	ASTM	B 674	Alloy 926	N08926	—	94/43 [648/296]	Welded Tube	35Ni-31Fe-24Cr-6Mo-3Cu

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys							
45	ASTM B 675	Fe-Ni-Cr-Mo	N08366	—	—	Welded Pipe	—
45	ASTM B 675	Alloy AL-6XXN	N08367	≤3/16 [5]	100/45 [689/310]	Welded Pipe	46Fe-24Ni-21Cr-6Mo-Cu-N
45	ASTM B 675	Alloy AL-6XXN	N08367	>3/16 [5]	95/45 [655/310]	Welded Pipe	46Fe-24Ni-21Cr-6Mo-Cu-N
45	ASTM B 676	Alloy AL-6XXN	N08367	≤3/16 [5]	100/45 [689/310]	Welded Tube	46Fe-24Ni-21Cr-6Mo-Cu-N
45	ASTM B 676	Alloy AL-6XXN	N08367	>3/16 [5]	95/45 [655/310]	Welded Tube	46Fe-24Ni-21Cr-6Mo-Cu-N
45	ASTM B 677	Alloy 904L	N08904	—	71/31 [490/214]	Seamless Pipe & Tube	44Fe-25Ni-21Cr-4.5Mo-Cu
45	ASTM B 677	Alloy 1925	N08925	—	87/43 [600/296]	Seamless Pipe & Tube	46Fe-25Ni-20Cr-6Mo-Cu-N
45	ASTM B 677	Alloy 926	N08926	—	94/43 [648/296]	Seamless Pipe & Tube	35Ni-31Fe-24Cr-6Mo-3Cu
45	ASTM B 688	Fe-Ni-Cr-Mo	N08366	—	—	Sheet & Strip	—
45	ASTM B 688	Alloy AL-6XXN	N08367	≤3/16 [5]	100/45 [689/310]	Sheet & Strip	46Fe-24Ni-21Cr-6Mo-Cu-N
45	ASTM B 688	Alloy AL-6XXN	N08367	>3/16 ≤3/4 [5 ≤19]	95/45 [655/310]	Plate	46Fe-24Ni-21Cr-6Mo-Cu-N
45	ASTM B 690	Fe-Ni-Cr-Mo	N08366	—	—	Sheet & Strip	—
45	ASTM B 690	Alloy AL-6XXN	N08367	≤3/16 [5]	100/45 [689/310]	Seamless Pipe & Tube	46Fe-24Ni-21Cr-6Mo-Cu-N
45	ASTM B 690	Alloy AL-6XXN	N08367	>3/16 ≤3/4 [5 ≤19]	95/45 [655/310]	Seamless Pipe & Tube	46Fe-24Ni-21Cr-6Mo-Cu-N
45	ASTM B 691	Fe-Ni-Cr-Mo	N08366	—	—	Round & Square Rods & Bars	—
45	ASTM B 691	Alloy AL-6XXN	N08367	—	95/45 [655/310]	Round & Sq. Rods & Bars	46Fe-24Ni-21Cr-6Mo-Cu-N
45	ASTM B 704	Alloy 825	N08825	—	85/35 [586/241]	Welded Tube	42Ni-30Fe-21.5Cr-3Mo-2.3Cu
45	ASTM B 705	Alloy 825	N08825	—	85/35 [586/241]	Welded Pipe	42Ni-30Fe-21.5Cr-3Mo-2.3Cu
45	ASTM B 709	Alloy 28	N08028	—	73/31 [503/214]	Plate, Sheet & Strip	31Ni-31Fe-29Cr-Mo
45	ASTM B 710	Alloy 330	N08330	—	70/30 [483/207]	Welded Pipe	42Fe-35.5Ni-18.5Cr-Si
45	ASTM B 710	Alloy 330TX	N08332	—	67/27 [462/186]	Welded Pipe	42Fe-35.5Ni-18.5Cr-Si
45	ASTM B 718	Alloy 333	N06333	—	80/35 [552/241]	Plate, Sheet & Strip	46Ni-25.5Cr-16Fe-3.3Mo-3.3W-3.3Co
45	ASTM B 719	Alloy 333	N06333	—	80/35 [552/241]	Bars	46Ni-25.5Cr-16Fe-3.3Mo-3.3W-3.3Co
45	ASTM B 720	Fe-Cr-Ni-Mo	N08310	—	—	Seamless Tube	—
45	ASTM B 722	Alloy 333	N06333	—	80/35 [552/241]	Seamless Pipe & Tube	46Ni-25.5Cr-16Fe-3.3Mo-3.3W-3.3Co
45	ASTM B 723	Alloy 333	N06333	—	80/35 [552/241]	Welded Pipe	46Ni-25.5Cr-16Fe-3.3Mo-3.3W-3.3Co
45	ASTM B 726	Alloy 333	N06333	—	80/35 [552/241]	Welded Tube	46Ni-25.5Cr-16Fe-3.3Mo-3.3W-3.3Co

(Continued)

Table D.2 (Continued)
M-Number List of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Nickel and Nickel Base Alloys								
45	ASTM	B 804	Alloy AL-6XN	N08367	≤3/16 [5]	100/45 [689/310]	Welded Pipe & Tube	46Fe-24Ni-21Cr-6.5Mo-Cu-W
45	ASTM	B 804	Alloy AL-6XN	N08367	>3/16 [5]	95/45 [655/310]	Welded Pipe & Tube	46Fe-24Ni-21Cr-6.5Mo-Cu-W
46	ASTM	B 163	Ni-Cr-Fe-Si (Alloy 45)	N06045	—	90/35 [621/241]	Seamless Tube	46Ni-27.5Cr-23Fe-2.75Si
46	ASTM	B 166	Ni-Cr-Fe (Alloy 45)	N06045	—	90/35 [621/241]	Rod & Bar	46Ni-27.5Cr-23Fe-2.75Si
46	ASTM	B 167	Ni-Cr-Fe (Alloy 45)	N06045	—	90/35 [621/241]	Seamless Pipe & Tube	46Ni-27.5Cr-23Fe-2.75Si
46	ASTM	B 168	Alloy 45	N06045	—	90/35 [621/241]	Plate, Sheet & Strip	46Ni-27.5Cr-23Fe-2.75Si
46	ASTM	B 366	CRV45TM/WPV45TM	N06045	—	90/35 [621/241]	Fittings	46Ni-27.5Cr-23Fe-2.75Si
46	ASTM	B 366	CRH160/WPH160	N12160	—	90/35 [621/241]	Fittings	37Ni-30Co-28Cr-2.7Si-Ti
46	ASTM	B 435	Alloy HR160	N12160	—	90/35 [621/241]	Plate, Sheet & Strip	37Ni-30Co-28Cr-2.7Si-Ti
46	ASTM	B 516	Alloy 45	N06045	—	90/35 [621/241]	Welded Tube	46Ni-27.5Cr-23Fe-2.75Si
46	ASTM	B 517	Alloy 45	N06045	—	90/35 [621/241]	Welded Pipe	46Ni-27.5Cr-23Fe-2.75Si
46	ASTM	B 564	Alloy 45	N06045	—	90/35 [621/241]	Forging	46Ni-27.5Cr-23Fe-2.75Si
46	ASTM	B 564	Alloy HR160	N12160	—	90/35 [621/241]	Forging	37Ni-30Co-28Cr-2.7Si-Ti
46	ASTM	B 572	Alloy HR160	N12160	—	90/35 [621/241]	Rod	37Ni-30Co-28Cr-2.7Si-Ti
46	ASTM	B 619	Alloy HR160	N12160	—	90/35 [621/241]	Welded Pipe	37Ni-30Co-28Cr-2.7Si-Ti
46	ASTM	B 622	Alloy HR160	N12160	—	90/35 [621/241]	Seamless Pipe & Tube	37Ni-30Co-28Cr-2.7Si-Ti
46	ASTM	B 626	Alloy HR160	N12160	—	90/35 [621/241]	Welded Tube	37Ni-30Co-28Cr-2.7Si-Ti

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
51	ASTM	B 265	Grade 1	R50250	—	35/25 [241/172]	Plate, Sheet & Strip	UnalloyedTi
51	ASTM	B 265	Grade 2	R50400	—	50/40 [345/276]	Plate, Sheet & Strip	UnalloyedTi
51	ASTM	B 265	Grade 7	R52400	—	50/40 [345/276]	Plate, Sheet & Strip	0.18Pd
51	ASTM	B 265	Grade 11	R52250	—	35/25 [241/172]	Plate, Sheet & Strip	0.18Pd
51	ASTM	B 265	Grade 13	R53413	—	40/25 [276/172]	Plate, Sheet & Strip	0.5Ni-0.05Ru
51	ASTM	B 265	Grade 16	R52402	—	50/40 [345/276]	Plate, Sheet & Strip	0.06Pd
51	ASTM	B 265	Grade 17	R52252	—	35/25 [241/172]	Plate, Sheet & Strip	0.06Pd
51	ASTM	B 265	Grade 26	—	—	50/40 [345/276]	Plate, Sheet & Strip	0.11Ru
51	ASTM	B 265	Grade 27	—	—	35/25 [241/172]	Plate, Sheet & Strip	0.11Ru
51	ASTM	B 265	Grade 30	—	—	50/40 [345/276]	Plate, Sheet & Strip	0.5Co-0.06Ru
51	ASTM	B 265	Grade 33	—	—	50/40 [345/276]	Plate, Sheet & Strip	0.45Ni-0.15Cr-Ru-Pd
51	ASTM	B 337	Grade 1	R50250	—	35/25 [241/172]	Seamless & Welded Pipe	UnalloyedTi
51	ASTM	B 337	Grade 2	R50400	—	50/40 [345/276]	Seamless & Welded Pipe	UnalloyedTi
51	ASTM	B 337	Grade 7	R52400	—	50/40 [345/276]	Seamless & Welded Pipe	0.18Pd
51	ASTM	B 337	Grade 11	R52250	—	35/25 [241/172]	Seamless & Welded Pipe	0.18Pd
51	ASTM	B 338	Grade 1	R50250	—	35/25 [241/172]	Seamless & Welded Tube	UnalloyedTi
51	ASTM	B 338	Grade 2	R50400	—	50/40 [345/276]	Seamless & Welded Tube	UnalloyedTi
51	ASTM	B 338	Grade 7	R52400	—	50/40 [345/276]	Seamless & Welded Tube	0.18Pd
51	ASTM	B 338	Grade 11	R52250	—	35/25 [241/172]	Seamless & Welded Tube	0.18Pd
51	ASTM	B 338	Grade 13	R53413	—	40/25 [276/172]	Seamless & Welded Tube	0.5Ni-0.05Ru
51	ASTM	B 338	Grade 16	R52402	—	50/40 [345/276]	Seamless & Welded Tube	0.06Pd
51	ASTM	B 338	Grade 17	R52252	—	35/25 [241/172]	Seamless & Welded Tube	0.06Pd
51	ASTM	B 338	Grade 27	—	—	35/25 [241/172]	Seamless & Welded Tube	0.11Ru
51	ASTM	B 338	Grade 30	—	—	50/40 [345/276]	Seamless & Welded Tube	0.5Co-0.06Pd
51	ASTM	B 338	Grade 33	—	—	50/40 [345/276]	Seamless & Welded Tube	0.45Ni-0.15Cr-Ru-Pd
51	ASTM	B 348	Grade 1	R50250	—	35/25 [241/172]	Flat Bars (Cold Finished)	UnalloyedTi
51	ASTM	B 348	Grade 1	R50250	—	35/25 [241/172]	Hex., Oct. & Squares (Cold Finished)	UnalloyedTi
51	ASTM	B 348	Grade 1	R50250	—	35/25 [241/172]	Rounds (Cold Finished)	UnalloyedTi

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
51	ASTM	B 348	Grade 1	R50250	—	35/25 [241/172]	Rounds & Squares (Hot Rolled)	UnalloyedTi
51	ASTM	B 348	Grade 1	R50250	—	35/25 [241/172]	Hexagons & Octagons (Hot Rolled)	UnalloyedTi
51	ASTM	B 348	Grade 1	R50250	—	35/25 [241/172]	Flat Bars (Hot Rolled)	UnalloyedTi
51	ASTM	B 348	Grade 2	R50400	—	50/40 [345/276]	Flat Bars (Cold Finished)	UnalloyedTi
51	ASTM	B 348	Grade 2	R50400	—	50/40 [345/276]	Hex., Oct. & Squares (Cold Finished)	UnalloyedTi
51	ASTM	B 348	Grade 2	R50400	—	50/40 [345/276]	Rounds (Cold Finished)	UnalloyedTi
51	ASTM	B 348	Grade 2	R50400	—	50/40 [345/276]	Rounds & Squares (Hot Rolled)	UnalloyedTi
51	ASTM	B 348	Grade 2	R50400	—	50/40 [345/276]	Hexagons & Octagons (Hot Rolled)	UnalloyedTi
51	ASTM	B 348	Grade 2	R50400	—	50/40 [345/276]	Flat Bars (Hot Rolled)	UnalloyedTi
51	ASTM	B 348	Grade 2	R50400	—	50/40 [345/276]	Flat Bars (Cold Finished)	0.18Pd
51	ASTM	B 348	Grade 11	R52250	—	35/25 [241/172]	Hex., Oct. & Squares (Cold Finished)	0.18Pd
51	ASTM	B 348	Grade 11	R52250	—	35/25 [241/172]	Rounds (Cold Finished)	0.18Pd
51	ASTM	B 348	Grade 11	R52250	—	35/25 [241/172]	Rounds & Squares (Hot Rolled)	0.18Pd
51	ASTM	B 348	Grade 11	R52250	—	35/25 [241/172]	Hexagons & Octagons (Hot Rolled)	0.18Pd
51	ASTM	B 348	Grade 11	R52250	—	35/25 [241/172]	Flat Bars (Hot Rolled)	0.18Pd
51	ASTM	B 348	Grade 17	R52252	—	35/25 [241/172]	Flat Bars (Cold Finished)	0.06Pd
51	ASTM	B 348	Grade 17	R52252	—	35/25 [241/172]	Hex., Oct. & Squares (Cold Finished)	0.06Pd
51	ASTM	B 348	Grade 17	R52252	—	35/25 [241/172]	Rounds (Cold Finished)	0.06Pd
51	ASTM	B 348	Grade 17	R52252	—	35/25 [241/172]	Rounds & Squares (Hot Rolled)	0.06Pd
51	ASTM	B 348	Grade 17	R52252	—	35/25 [241/172]	Hexagons & Octagons (Hot Rolled)	0.06Pd
51	ASTM	B 348	Grade 17	R52252	—	35/25 [241/172]	Flat Bars (Hot Rolled)	0.06Pd
51	ASTM	B 348	Grade 7	R52400	—	50/40 [345/276]	Flat Bars (Cold Finished)	0.18Pd
51	ASTM	B 348	Grade 7	R52400	—	50/40 [345/276]	Hex., Oct. & Squares (Cold Finished)	0.18Pd
51	ASTM	B 348	Grade 7	R52400	—	50/40 [345/276]	Rounds (Cold Finished)	0.18Pd
51	ASTM	B 348	Grade 7	R52400	—	50/40 [345/276]	Rounds & Squares (Hot Rolled)	0.18Pd
51	ASTM	B 348	Grade 7	R52400	—	50/40 [345/276]	Hexagons & Octagons (Hot Rolled)	0.18Pd
51	ASTM	B 348	Grade 7	R52400	—	50/40 [345/276]	Flat Bars (Hot Rolled)	0.18Pd
51	ASTM	B 348	Grade 7	R52400	—	50/40 [345/276]	Flat Bars (Cold Finished)	0.06Pd
51	ASTM	B 348	Grade 16	R52402	—	50/40 [345/276]	Flat Bars (Cold Finished)	0.06Pd
51	ASTM	B 348	Grade 16	R52402	—	50/40 [345/276]	Hex., Oct. & Squares (Cold Finished)	0.06Pd

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
51	ASTM	B 348	Grade 16	R52402	—	50/40 [345/276]	Rounds (Cold Finished)	0.06Pd
51	ASTM	B 348	Grade 16	R52402	—	50/40 [345/276]	Rounds & Squares (Hot Rolled)	0.06Pd
51	ASTM	B 348	Grade 16	R52402	—	50/40 [345/276]	Hexagons & Octagons (Hot Rolled)	0.06Pd
51	ASTM	B 348	Grade 16	R52402	—	50/40 [345/276]	Flat Bars (Hot Rolled)	0.06Pd
51	ASTM	B 348	Grade 13	R53413	—	40/25 [276/172]	Flat Bars (Cold Finished)	0.5Ni-0.05Ru
51	ASTM	B 348	Grade 13	R53413	—	40/25 [276/172]	Hex., Oct. & Squares (Cold Finished)	0.5Ni-0.05Ru
51	ASTM	B 348	Grade 13	R53413	—	40/25 [276/172]	Rounds (Cold Finished)	0.5Ni-0.05Ru
51	ASTM	B 348	Grade 13	R53413	—	40/25 [276/172]	Rounds & Squares (Hot Rolled)	0.5Ni-0.05Ru
51	ASTM	B 348	Grade 13	R53413	—	40/25 [276/172]	Hexagons & Octagons (Hot Rolled)	0.5Ni-0.05Ru
51	ASTM	B 348	Grade 13	R53413	—	40/25 [276/172]	Flat Bars (Hot Rolled)	0.5Ni-0.05Ru
51	ASTM	B 348	Grade 30	—	—	50/40 [345/276]	Flat Bars (Cold Finished)	0.5Co-0.06Pd
51	ASTM	B 348	Grade 30	—	—	50/40 [345/276]	Hex., Oct. & Squares (Cold Finished)	0.5Co-0.06Pd
51	ASTM	B 348	Grade 30	—	—	50/40 [345/276]	Rounds (Cold Finished)	0.5Co-0.06Pd
51	ASTM	B 348	Grade 30	—	—	50/40 [345/276]	Rounds & Squares (Hot Rolled)	0.5Co-0.06Pd
51	ASTM	B 348	Grade 30	—	—	50/40 [345/276]	Hexagons & Octagons (Hot Rolled)	0.5Co-0.06Pd
51	ASTM	B 348	Grade 30	—	—	50/40 [345/276]	Flat Bars (Hot Rolled)	0.5Co-0.06Pd
51	ASTM	B 348	Grade 33	—	—	50/40 [345/276]	Flat Bars (Cold Finished)	0.45Ni-Cr-Ru-Pd
51	ASTM	B 348	Grade 33	—	—	50/40 [345/276]	Hex., Oct. & Squares (Cold Finished)	0.45Ni-Cr-Ru-Pd
51	ASTM	B 348	Grade 33	—	—	50/40 [345/276]	Rounds (Cold Finished)	0.45Ni-Cr-Ru-Pd
51	ASTM	B 348	Grade 33	—	—	50/40 [345/276]	Rounds & Squares (Hot Rolled)	0.45Ni-Cr-Ru-Pd
51	ASTM	B 348	Grade 33	—	—	50/40 [345/276]	Hexagons & Octagons (Hot Rolled)	0.45Ni-Cr-Ru-Pd
51	ASTM	B 348	Grade 33	—	—	50/40 [345/276]	Flat Bars (Hot Rolled)	0.45Ni-Cr-Ru-Pd
51	ASTM	B 363	WPT 1	R50250	—	35/25 [241/172]	Seamless & Welded Fittings	UnalloyedTi
51	ASTM	B 363	WPT 2	R50400	—	50/40 [345/276]	Seamless & Welded Fittings	UnalloyedTi
51	ASTM	B 363	WPT 7	R52400	—	50/40 [345/276]	Seamless & Welded Fittings	0.18Pd
51	ASTM	B 363	WPT 11	R52250	—	35/25 [241/172]	Seamless & Welded Fittings	0.18Pd
51	ASTM	B 363	WPT 13	R53413	—	40/25 [276/172]	Seamless & Welded Fittings	0.5Ni-0.05Ru
51	ASTM	B 363	WPT 16	R52402	—	50/40 [345/276]	Seamless & Welded Fittings	0.06Pd
51	ASTM	B 363	WPT 17	R52252	—	35/25 [241/172]	Seamless & Welded Fittings	0.06Pd

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
51	ASTM	B 363	WPT 30	—	—	50/40 [345/276]	Seamless & Welded Fittings	0.5Ni-0.06Pd
51	ASTM	B 367	Grade C-2	R50400	—	50/40 [345/276]	Castings (As-Cast)	UnalloyedTi
51	ASTM	B 367	Pd 17	R52252	—	35/25 [241/172]	Castings (As-Cast)	0.06Pd
51	ASTM	B 367	Pd 7B	R52401	—	50/40 [345/276]	Castings (As-Cast)	0.12minPd
51	ASTM	B 367	Pd 16	R52402	—	50/40 [345/276]	Castings (As-Cast)	0.06Pd
51	ASTM	B 381	F-1	R50250	—	35/25 [241/172]	Forgings	UnalloyedTi
51	ASTM	B 381	F-2	R50400	—	50/40 [345/276]	Forgings	UnalloyedTi
51	ASTM	B 381	F-7	R52400	—	50/40 [345/276]	Forgings	0.18Pd
51	ASTM	B 381	F-11	R52250	—	35/25 [241/172]	Forgings	0.18Pd
51	ASTM	B 381	F-13	R53413	—	40/25 [276/172]	Forgings	0.5Ni-0.05Ru
51	ASTM	B 381	F-16	R52402	—	50/40 [345/276]	Forgings	0.06Pd
51	ASTM	B 381	F-17	R52252	—	35/25 [241/172]	Forgings	0.06Pd
51	ASTM	B 381	F-30	—	—	50/40 [345/276]	Forgings	0.5Co-0.06Pd
51	ASTM	B 381	F-33	—	—	50/40 [345/276]	Forgings	0.4Ni-0.15Cr-Ru-Pd
51	ASTM	B 861	Grade 1	R50250	—	35/25 [241/172]	Seamless Pipe	UnalloyedTi
51	ASTM	B 861	Grade 2	R50400	—	50/40 [345/276]	Seamless Pipe	UnalloyedTi
51	ASTM	B 861	Grade 7	R52400	—	50/40 [345/276]	Seamless Pipe	0.18Pd
51	ASTM	B 861	Grade 11	R52250	—	35/25 [241/172]	Seamless Pipe	0.18Pd
51	ASTM	B 861	Grade 13	R53413	—	40/25 [276/172]	Seamless Pipe	0.5Ni-0.05Ru
51	ASTM	B 861	Grade 16	R52402	—	50/40 [345/276]	Seamless Pipe	0.06Pd
51	ASTM	B 861	Grade 17	R52252	—	35/25 [241/172]	Seamless Pipe	0.06Pd
51	ASTM	B 861	Grade 33	—	—	50/40 [345/276]	Seamless Pipe	0.4Ni-0.15Cr-Ru-Pd
51	ASTM	B 862	Grade 1	R50250	—	35/25 [241/172]	Welded Pipe	UnalloyedTi
51	ASTM	B 862	Grade 2	R50400	—	50/40 [345/276]	Welded Pipe	UnalloyedTi
51	ASTM	B 862	Grade 7	R52400	—	50/40 [345/276]	Welded Pipe	0.18Pd
51	ASTM	B 862	Grade 11	R50250	—	35/25 [241/172]	Welded Pipe	0.18Pd
51	ASTM	B 862	Grade 13	R53413	—	40/25 [276/172]	Welded Pipe	0.5Ni-0.05Ru
51	ASTM	B 862	Grade 16	R52402	—	50/40 [345/276]	Welded Pipe	0.06Pd
51	ASTM	B 862	Grade 17	R52252	—	35/25 [241/172]	Welded Pipe	0.06Pd

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
51	ASTM	B 862	Grade 26	R52404	—	50/40 [345/276]	Welded Pipe	0.11Ru
51	ASTM	B 862	Grade 27	R52254	—	35/25 [241/172]	Welded Pipe	0.11Ru
51	ASTM	B 862	Grade 33	—	—	50/40 [345/276]	Welded Pipe	0.4Ni-0.15Cr-Ru-Pd
52	ASTM	B 265	Grade 3	R50550	—	65/55 [448/379]	Plate, Sheet & Strip	UnalloyedTi
52	ASTM	B 265	Grade 12	R53400	—	70/50 [483/345]	Plate, Sheet & Strip	0.75Ni-0.3Mo
52	ASTM	B 265	Grade 14	R53414	—	60/40 [414/276]	Plate, Sheet & Strip	0.5Ni-0.05Ru
52	ASTM	B 265	Grade 15	R53415	—	70/55 [483/379]	Plate, Sheet & Strip	0.5Ni-0.05Ru
52	ASTM	B 265	Grade 31	—	—	65/55 [448/379]	Plate, Sheet & Strip	0.5Co-0.06Pd
52	ASTM	B 265	Grade 34	—	—	65/55 [448/379]	Plate, Sheet & Strip	0.4Ni-0.15Cr-Ru-Pd
52	ASTM	B 337	Grade 3	R50550	—	66/55 [455/379]	Seamless & Welded Pipe	UnalloyedTi
52	ASTM	B 337	Grade 12	R53400	—	70/50 [483/345]	Seamless & Welded Pipe	0.75Ni-0.3Mo
52	ASTM	B 338	Grade 3	R50550	—	65/55 [448/379]	Seamless & Welded Tube	UnalloyedTi
52	ASTM	B 338	Grade 12	R53400	—	70/50 [483/345]	Seamless & Welded Tube	0.75Ni-0.3Mo
52	ASTM	B 338	Grade 14	R53414	—	60/40 [414/276]	Seamless & Welded Tube	0.5Ni-0.05Ru
52	ASTM	B 338	Grade 15	R53415	—	70/55 [483/379]	Seamless & Welded Tube	0.5Ni-0.05Ru
52	ASTM	B 338	Grade 31	—	—	65/55 [448/379]	Seamless & Welded Tube	0.5Co-0.06Pd
52	ASTM	B 338	Grade 34	—	—	65/55 [448/379]	Seamless & Welded Tube	0.4Ni-0.15Cr-Ru-Pd
52	ASTM	B 348	Grade 3	R50550	—	65/55 [448/379]	Rounds & Squares (Hot Rolled)	UnalloyedTi
52	ASTM	B 348	Grade 3	R50550	—	65/55 [448/379]	Hexagons & Octagons (Hot Rolled)	UnalloyedTi
52	ASTM	B 348	Grade 3	R50550	—	65/55 [448/379]	Flat Bars (Hot Rolled)	UnalloyedTi
52	ASTM	B 348	Grade 3	R50550	—	65/55 [448/379]	Rounds (Cold Finished)	UnalloyedTi
52	ASTM	B 348	Grade 3	R50550	—	65/55 [448/379]	Hex., Oct. & Squares (Cold Finished)	UnalloyedTi
52	ASTM	B 348	Grade 3	R50550	—	65/55 [448/379]	Flat Bars (Cold Finished)	UnalloyedTi
52	ASTM	B 348	Grade 12	R53400	—	70/50 [483/345]	Rounds & Squares (Hot Rolled)	0.75Ni-0.3Mo
52	ASTM	B 348	Grade 12	R53400	—	70/50 [483/345]	Hexagons & Octagons (Hot Rolled)	0.75Ni-0.3Mo
52	ASTM	B 348	Grade 12	R53400	—	70/50 [483/345]	Flat Bars (Hot Rolled)	0.75Ni-0.3Mo
52	ASTM	B 348	Grade 12	R53400	—	70/50 [483/345]	Rounds (Cold Finished)	0.75Ni-0.3Mo
52	ASTM	B 348	Grade 12	R53400	—	70/50 [483/345]	Hex., Oct. & Squares (Cold Finished)	0.75Ni-0.3Mo

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
52	ASTM	B 348	Grade 12	R53400	—	70/50 [483/345]	Flat Bars (Cold Finished)	0.75Ni-0.3Mo
52	ASTM	B 348	Grade 14	R53414	—	60/40 [414/276]	Rounds & Squares (Hot Rolled)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 14	R53414	—	60/40 [414/276]	Hexagons & Octagons (Hot Rolled)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 14	R53414	—	60/40 [414/276]	Flat Bars (Hot Rolled)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 14	R53414	—	60/40 [414/276]	Rounds (Cold Finished)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 14	R53414	—	60/40 [414/276]	Hex., Oct. & Squares (Cold Finished)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 14	R53414	—	60/40 [414/276]	Flat Bars (Cold Finished)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 15	R53415	—	70/55 [483/379]	Rounds & Squares (Hot Rolled)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 15	R53415	—	70/55 [483/379]	Hexagons & Octagons (Hot Rolled)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 15	R53415	—	70/55 [483/379]	Flat Bars (Hot Rolled)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 15	R53415	—	70/55 [483/379]	Rounds (Cold Finished)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 15	R53415	—	70/55 [483/379]	Hex., Oct. & Squares (Cold Finished)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 15	R53415	—	70/55 [483/379]	Flat Bars (Cold Finished)	0.5Ni-0.05Ru
52	ASTM	B 348	Grade 31	—	—	65/55 [448/379]	Rounds & Squares (Hot Rolled)	0.3Co-0.05Pd
52	ASTM	B 348	Grade 31	—	—	65/55 [448/379]	Hexagons & Octagons (Hot Rolled)	0.3Co-0.05Pd
52	ASTM	B 348	Grade 31	—	—	65/55 [448/379]	Flat Bars (Hot Rolled)	0.3Co-0.05Pd
52	ASTM	B 348	Grade 31	—	—	65/55 [448/379]	Rounds (Cold Finished)	0.3Co-0.05Pd
52	ASTM	B 348	Grade 31	—	—	65/55 [448/379]	Hex., Oct. & Squares (Cold Finished)	0.3Co-0.05Pd
52	ASTM	B 348	Grade 31	—	—	65/55 [448/379]	Flat Bars (Cold Finished)	0.3Co-0.05Pd
52	ASTM	B 348	Grade 34	—	—	65/55 [448/379]	Rounds & Squares (Hot Rolled)	0.4Ni-Cr-Ru-Pd
52	ASTM	B 348	Grade 34	—	—	65/55 [448/379]	Hexagons & Octagons (Hot Rolled)	0.4Ni-Cr-Ru-Pd
52	ASTM	B 348	Grade 34	—	—	65/55 [448/379]	Flat Bars (Hot Rolled)	0.4Ni-Cr-Ru-Pd
52	ASTM	B 348	Grade 34	—	—	65/55 [448/379]	Rounds (Cold Finished)	0.4Ni-Cr-Ru-Pd
52	ASTM	B 348	Grade 34	—	—	65/55 [448/379]	Hex., Oct. & Squares (Cold Finished)	0.4Ni-Cr-Ru-Pd
52	ASTM	B 348	Grade 34	—	—	65/55 [448/379]	Flat Bars (Cold Finished)	0.4Ni-Cr-Ru-Pd
52	ASTM	B 363	WPT 3	R50550	—	65/55 [448/379]	Seamless & Welded Fittings	UnalloyedTi
52	ASTM	B 363	WPT 12	R53400	—	70/50 [483/345]	Seamless & Welded Fittings	0.75Ni-0.3Mo
52	ASTM	B 363	WPT 14	R53414	—	60/40 [414/276]	Seamless & Welded Fittings	0.5Ni-0.05Ru
52	ASTM	B 363	WPT 15	R53415	—	65/55 [448/379]	Seamless & Welded Fittings	0.5Ni-0.05Ru

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
52	ASTM	B 367	Grade C-3	R50550	—	65/55 [448/379]	Castings (As-Cast)	UnalloyedTi
52	ASTM	B 367	Pd 8A	R52401	—	65/55 [448/379]	Castings (As-Cast)	0.12minPd
52	ASTM	B 381	F-3	R50550	—	65/55 [448/379]	Forgings	UnalloyedTi
52	ASTM	B 381	F-12	R53400	—	70/50 [483/345]	Forgings	0.75Ni-0.3Mo
52	ASTM	B 381	F-14	R53414	—	60/40 [414/276]	Forgings	0.5Ni-0.05Ru
52	ASTM	B 381	F-15	R53415	—	70/55 [483/379]	Forgings	0.5Ni-0.05Ru
52	ASTM	B 381	F-31	—	—	65/55 [448/379]	Forgings	0.3Co-0.05Pd
52	ASTM	B 861	Grade 3	R50550	—	65/55 [448/379]	Seamless Pipe	UnalloyedTi
52	ASTM	B 861	Grade 12	R53400	—	70/50 [483/345]	Seamless Pipe	0.8Ni-0.3Mo
52	ASTM	B 861	Grade 14	R53414	—	60/40 [414/276]	Seamless Pipe	0.5Ni-0.05Ru
52	ASTM	B 861	Grade 15	R53415	—	70/55 [483/379]	Seamless Pipe	0.5Ni-0.05Ru
52	ASTM	B 861	Grade 34	—	—	65/55 [448/379]	Seamless Pipe	0.4Ni-0.15Cr-Ru-Pd
52	ASTM	B 862	Grade 3	R50550	—	65/55 [448/379]	Seamless Pipe	UnalloyedTi
52	ASTM	B 862	Grade 12	R53400	—	70/50 [483/345]	Seamless Pipe	0.03Co-0.05Pd
52	ASTM	B 862	Grade 14	R53414	—	60/40 [414/276]	Seamless Pipe	0.5Ni-0.05Ru
52	ASTM	B 862	Grade 15	R53415	—	70/55 [483/379]	Seamless Pipe	0.5Ni-0.05Ru
52	ASTM	B 862	Grade 34	—	—	65/55 [448/379]	Welded Pipe	0.4Ni-0.15Cr-Ru-Pd
53	ASTM	B 265	Grade 4	R50700	—	80/70 [552/483]	Plate, Sheet & Strip	UnalloyedTi
53	ASTM	B 265	Grade 9	R56320	—	90/70 [621/483]	Plate, Sheet & Strip	3Al-2.5V
53	ASTM	B 265	Grade 18	R56322	—	90/70 [621/483]	Plate, Sheet & Strip	3Al-2.5V-0.06Pd
53	ASTM	B 265	Grade 28	R56323	—	90/70 [621/483]	Plate, Sheet & Strip	3Al-2.5V-0.11Ru
53	ASTM	B 265	Grade 21	R58210	—	115/110 [793/758]	Plate, Sheet & Strip	15Mo-3Al-2.7Nb-0.25Si
53	ASTM	B 265	Grade 19	R58640	—	115/110 [793/758]	Plate, Sheet & Strip	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 265	Grade 20	R58645	—	115/110 [793/758]	Plate, Sheet & Strip	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 265	Grade 32	—	—	100/85 [689/586]	Plate, Sheet & Strip	5Al-1Sn-1Zr-1V-0.9Mo
53	ASTM	B 337	Grade 9	R56320	—	90/70 [621/483]	Seamless & Welded Pipe	3Al-2.5V
53	ASTM	B 338	Grade 9	R56320	—	90/70 [621/483]	Seamless & Welded Tube	3Al-2.5V
53	ASTM	B 338	Grade 18	R56322	—	90/70 [621/483]	Seamless & Welded Tube	3Al-2.5V-0.06Pd

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
53	ASTM	B 338	Grade 28	R56323	—	90/70 [621/483]	Seamless & Welded Tube	3Al-2.5V-0.11Ru
53	ASTM	B 348	Grade 4	R50700	—	80/70 [552/483]	Rounds & Squares (Hot Rolled)	UnalloyedTi
53	ASTM	B 348	Grade 4	R50700	—	80/70 [552/483]	Hexagons & Octagons (Hot Rolled)	UnalloyedTi
53	ASTM	B 348	Grade 4	R50700	—	80/70 [552/483]	Flat Bars (Hot Rolled)	UnalloyedTi
53	ASTM	B 348	Grade 4	R50700	—	80/70 [552/483]	Rounds (Cold Finished)	UnalloyedTi
53	ASTM	B 348	Grade 4	R50700	—	80/70 [552/483]	Hex., Oct. & Squares (Cold Finished)	UnalloyedTi
53	ASTM	B 348	Grade 4	R50700	—	80/70 [552/483]	Flat Bars (Cold Finished)	UnalloyedTi
53	ASTM	B 348	Grade 9	R56320	—	90/70 [621/483]	Rounds & Squares (Hot Rolled)	3Al-2.5V
53	ASTM	B 348	Grade 9	R56320	—	90/70 [621/483]	Hexagons & Octagons (Hot Rolled)	3Al-2.5V
53	ASTM	B 348	Grade 9	R56320	—	90/70 [621/483]	Flat Bars (Hot Rolled)	3Al-2.5V
53	ASTM	B 348	Grade 9	R56320	—	90/70 [621/483]	Rounds (Cold Finished)	3Al-2.5V
53	ASTM	B 348	Grade 9	R56320	—	90/70 [621/483]	Hex., Oct. & Squares (Cold Finished)	3Al-2.5V
53	ASTM	B 348	Grade 9	R56320	—	90/70 [621/483]	Flat Bars (Cold Finished)	3Al-2.5V
53	ASTM	B 348	Grade 18	R56322	—	90/70 [621/483]	Rounds & Squares (Hot Rolled)	3Al-2.5V-0.06Pd
53	ASTM	B 348	Grade 18	R56322	—	90/70 [621/483]	Hexagons & Octagons (Hot Rolled)	3Al-2.5V-0.06Pd
53	ASTM	B 348	Grade 18	R56322	—	90/70 [621/483]	Flat Bars (Hot Rolled)	3Al-2.5V-0.06Pd
53	ASTM	B 348	Grade 18	R56322	—	90/70 [621/483]	Rounds (Cold Finished)	3Al-2.5V-0.06Pd
53	ASTM	B 348	Grade 18	R56322	—	90/70 [621/483]	Hex., Oct. & Squares (Cold Finished)	3Al-2.5V-0.06Pd
53	ASTM	B 348	Grade 18	R56322	—	90/70 [621/483]	Flat Bars (Cold Finished)	3Al-2.5V-0.06Pd
53	ASTM	B 348	Grade 21	R58210	—	115/110 [793/758]	Rounds & Squares (Hot Rolled, Solution Treated)	15Mo-3Al-2.7Nb-0.25Si
53	ASTM	B 348	Grade 21	R58210	—	115/110 [793/758]	Hex. & Oct. (Hot Rolled, Solution Treated)	15Mo-3Al-2.7Nb-0.25Si
53	ASTM	B 348	Grade 21	R58210	—	115/110 [793/758]	Flat Bars (Hot Rolled, Solution Treated)	15Mo-3Al-2.7Nb-0.25Si
53	ASTM	B 348	Grade 21	R58210	—	115/110 [793/758]	Rounds (Cold Finished)	15Mo-3Al-2.7Nb-0.25Si
53	ASTM	B 348	Grade 21	R58210	—	115/110 [793/758]	Hex., Oct. & Squares (Cold Finished, Solution Treated)	15Mo-3Al-2.7Nb-0.25Si
53	ASTM	B 348	Grade 21	R58210	—	115/110 [793/758]	Flat Bars (Cold Finished, (Cold Finished, Solution Treated)	15Mo-3Al-2.7Nb-0.25Si

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
53	ASTM	B 348	Grade 19	R58640	—	115/110 [793/758]	Rounds & Squares (Hot Rolled, Cold Finished, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 348	Grade 19	R58640	—	115/110 [793/758]	Hex. & Oct. (Hot Rolled, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 348	Grade 19	R58640	—	115/110 [793/758]	Flat Bars (Hot Rolled, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 348	Grade 19	R58640	—	115/110 [793/758]	Rounds (Cold Finished, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 348	Grade 19	R58640	—	115/110 [793/758]	Hex., Oct. & Squares (Cold Finished, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 348	Grade 19	R58640	—	115/110 [793/758]	Flat Bars (Cold Finished, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 348	Grade 20	R58645	—	115/110 [793/758]	Rounds & Squares (Hot Rolled, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 348	Grade 20	R58645	—	115/110 [793/758]	Hex. & Oct. (Hot Rolled, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 348	Grade 20	R58645	—	115/110 [793/758]	Flat Bars (Hot Rolled, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 348	Grade 20	R58645	—	115/110 [793/758]	Rounds (Cold Finished, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 348	Grade 20	R58645	—	115/110 [793/758]	Hex., Oct. & Squares (Cold Finished, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 348	Grade 20	R58645	—	115/110 [793/758]	Flat Bars (Cold Finished, Solution Treated)	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 348	Grade 32	—	—	100/85 [689/586]	Rounds & Squares (Hot Rolled, Solution Treated)	5Al-1Sn-1Zr-1V-0.9Mo
53	ASTM	B 348	Grade 32	—	—	100/85 [689/586]	Hex. & Oct. (Hot Rolled, Solution Treated)	5Al-1Sn-1Zr-1V-0.9Mo
53	ASTM	B 348	Grade 32	—	—	100/85 [689/586]	Flat Bars (Hot Rolled, Solution Treated)	5Al-1Sn-1Zr-1V-0.9Mo
53	ASTM	B 348	Grade 32	—	—	100/85 [689/586]	Rounds (Cold Finished, Solution Treated)	5Al-1Sn-1Zr-1V-0.9Mo
53	ASTM	B 348	Grade 32	—	—	100/85 [689/586]	Hex., Oct. & Squares (Cold Finished, Solution Treated)	5Al-1Sn-1Zr-1V-0.9Mo
53	ASTM	B 348	Grade 32	—	—	100/85 [689/586]	Flat Bars (Cold Finished, Solution Treated)	5Al-1Sn-1Zr-1V-0.9Mo
53	ASTM	B 363	WPT 9	R56320	—	90/70 [621/483]	Seamless & Welded Fittings	3Al-2.5V

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
53	ASTM	B 363	WPT 18	R56322	—	90/70 [621/483]	Seamless & Welded Fittings	3Al-2.5V-0.06Pd
53	ASTM	B 363	WPT 21	R58210	—	115/110 [793/758]	Seamless & Welded Fittings	15Mo-3Al-2.7Nb-0.25Si
53	ASTM	B 363	WPT 19	R58640	—	115/110 [793/758]	Seamless & Welded Fittings	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 363	WPT 20	R58645	—	115/110 [793/758]	Seamless & Welded Fittings	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 381	F-4	R50700	—	80/70 [552/483]	Forgings	UnalloyedTi
53	ASTM	B 381	F-9	R56320	—	90/70 [621/483]	Forgings	3Al-2.5V
53	ASTM	B 381	F-18	R56322	—	90/70 [621/483]	Forgings	3Al-2.5V-0.06Pd
53	ASTM	B 381	F-21	R58210	—	115/110 [793/758]	Forgings (Solution Treated)	15Mo-3Al-2.7Nb-0.25Si
53	ASTM	B 381	F-19	R58640	—	115/110 [793/758]	Forgings (Solution Treated)	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 381	F-20	R58645	—	115/110 [793/758]	Forgings (Solution Treated)	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 861	Grade 9	R56320	—	90/70 [621/483]	Seamless Pipe	3Al-2.5V
53	ASTM	B 861	Grade 18	R56322	—	90/70 [621/483]	Seamless Pipe	3Al-2.5V-0.06Pd
53	ASTM	B 861	Grade 19	R58640	—	115/110 [793/758]	Seamless Pipe	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 861	Grade 20	R58645	—	115/110 [793/758]	Seamless Pipe	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 861	Grade 21	R58210	—	140/130 [965/896]	Seamless Pipe	15Mo-3Al-2.7Nb-0.25Si
53	ASTM	B 861	Grade 28	R56323	—	90/70 [621/483]	Seamless Pipe	3Al-2.5V-0.11Ru
53	ASTM	B 862	Grade 9	R56320	—	90/70 [621/483]	Welded Pipe	3Al-2.5V
53	ASTM	B 862	Grade 18	R56322	—	90/70 [621/483]	Welded Pipe	3Al-2.5V-0.06Pd
53	ASTM	B 862	Grade 19	R58640	—	115/110 [793/758]	Welded Pipe	8V-6Cr-4Zr-4Mo-3Al
53	ASTM	B 862	Grade 20	R58645	—	115/110 [793/758]	Welded Pipe	8V-6Cr-4Zr-4Mo-3Al-0.06Pd
53	ASTM	B 862	Grade 21	R58210	—	140/130 [965/896]	Welded Pipe	15Mo-3Al-2.7Nb-0.25Si
53	ASTM	B 862	Grade 28	R56323	—	90/70 [621/483]	Welded Pipe	3Al-2.5V-0.11Ru
53	AMS	4914	15-3	R58153	—	98/96 [676/662]	Sheet (Solution Treated)	15V-3Cr-3Sn-3Al
54	ASTM	B 265	Grade 5	R56400	—	130/120 [896/827]	Plate, Sheet & Strip	6Al-4V
54	ASTM	B 265	Grade 6	R54520	—	120/115 [827/724]	Plate, Sheet & Strip	5Al-2.5Sn
54	ASTM	B 265	Grade 24	R56405	—	130/120 [896/827]	Plate, Sheet & Strip	6Al-4V-0.06Pd
54	ASTM	B 265	Grade 25	R56403	—	130/120 [896/827]	Plate, Sheet & Strip	6Al-4V-0.55Ni-0.06Pd
54	ASTM	B 265	Grade 29	R56404	—	120/110 [827/758]	Plate, Sheet & Strip	6Al-4V-0.11Ru

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form		Nominal Composition
Titanium and Titanium Base Alloys									
54	ASTM	B 265	Grade 35	—	—	130/120 [896/827]	Plate, Sheet & Strip		4.5Al-2Mo-1.6V-Si-Fe
54	ASTM	B 338	Grade 35	—	—	130/120 [896/827]	Seamless & Welded Tube		4.5Al-2Mo-1.6V-Si-Fe
54	ASTM	B 348	Grade 5	R56400	—	130/120 [896/827]	Flat Bars (Cold Finished)		6Al-4V
54	ASTM	B 348	Grade 5	R56400	—	130/120 [896/827]	Hex., Oct. & Squares (Cold Finished)		6Al-4V
54	ASTM	B 348	Grade 5	R56400	—	130/120 [896/827]	Rounds (Cold Finished)		6Al-4V
54	ASTM	B 348	Grade 5	R56400	—	130/120 [896/827]	Hexagons & Octagons (Hot Rolled)		6Al-4V
54	ASTM	B 348	Grade 5	R56400	—	130/120 [896/827]	Rounds & Squares (Hot Rolled)		6Al-4V
54	ASTM	B 348	Grade 5	R56400	—	130/120 [896/827]	Flat Bars (Hot Rolled)		6Al-4V
54	ASTM	B 348	Grade 6	R54520	—	120/115 [827/793]	Flat Bars (Cold Finished)		5Al-2.5Sn
54	ASTM	B 348	Grade 6	R54520	—	120/115 [827/793]	Hex., Oct. & Squares (Cold Finished)		5Al-2.5Sn
54	ASTM	B 348	Grade 6	R54520	—	120/115 [827/793]	Rounds (Cold Finished)		5Al-2.5Sn
54	ASTM	B 348	Grade 6	R54520	—	120/115 [827/793]	Hexagons & Octagons (Hot Rolled)		5Al-2.5Sn
54	ASTM	B 348	Grade 6	R54520	—	120/115 [827/793]	Rounds & Squares (Hot Rolled)		5Al-2.5Sn
54	ASTM	B 348	Grade 6	R54520	—	120/115 [827/793]	Flat Bars (Hot Rolled)		5Al-2.5Sn
54	ASTM	B 348	Grade 23	R56402	—	120/110 [827/758]	Flat Bars (Cold Finished)		6Al-4V(ELI)
54	ASTM	B 348	Grade 23	R56402	—	120/110 [827/758]	Hex., Oct. & Squares (Cold Finished)		6Al-4V(ELI)
54	ASTM	B 348	Grade 23	R56402	—	120/110 [827/758]	Rounds (Cold Finished)		6Al-4V(ELI)
54	ASTM	B 348	Grade 23	R56402	—	120/110 [827/758]	Hexagons & Octagons (Hot Rolled)		6Al-4V(ELI)
54	ASTM	B 348	Grade 23	R56402	—	120/110 [827/758]	Rounds & Squares (Hot Rolled)		6Al-4V(ELI)
54	ASTM	B 348	Grade 23	R56402	—	120/110 [827/758]	Flat Bars (Hot Rolled)		6Al-4V(ELI)
54	ASTM	B 348	Grade 24	R56405	—	130/120 [896/827]	Flat Bars (Cold Finished)		6Al-4V-0.06Pd
54	ASTM	B 348	Grade 24	R56405	—	130/120 [896/827]	Hex., Oct. & Squares (Cold Finished)		6Al-4V-0.06Pd
54	ASTM	B 348	Grade 24	R56405	—	130/120 [896/827]	Rounds (Cold Finished)		6Al-4V-0.06Pd
54	ASTM	B 348	Grade 24	R56405	—	130/120 [896/827]	Hexagons & Octagons (Hot Rolled)		6Al-4V-0.06Pd
54	ASTM	B 348	Grade 24	R56405	—	130/120 [896/827]	Rounds & Squares (Hot Rolled)		6Al-4V-0.06Pd
54	ASTM	B 348	Grade 24	R56405	—	130/120 [896/827]	Flat Bars (Hot Rolled)		6Al-4V-0.06Pd
54	ASTM	B 348	Grade 25	R56403	—	130/120 [896/827]	Flat Bars (Cold Finished)		6Al-4V-0.55Ni-0.06Pd
54	ASTM	B 348	Grade 25	R56403	—	130/120 [896/827]	Hex., Oct. & Squares (Cold Finished)		6Al-4V-0.55Ni-0.06Pd
54	ASTM	B 348	Grade 25	R56403	—	130/120 [896/827]	Rounds (Cold Finished)		6Al-4V-0.55Ni-0.06Pd

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
54	ASTM	B 348	Grade 25	R56403	—	130/120 [896/827]	Hexagons & Octagons (Hot Rolled)	6Al-4V-0.55Ni-0.06Pd
54	ASTM	B 348	Grade 25	R56403	—	130/120 [896/827]	Rounds & Squares (Hot Rolled)	6Al-4V-0.55Ni-0.06Pd
54	ASTM	B 348	Grade 25	R56403	—	130/120 [896/827]	Flat Bars (Hot Rolled)	6Al-4V-0.55Ni-0.06Pd
54	ASTM	B 348	Grade 35	—	—	130/120 [896/827]	Flat Bars (Cold Finished)	4Al-2Mo-1.6V-Fe-Si
54	ASTM	B 348	Grade 35	—	—	130/120 [896/827]	Hex., Oct. & Squares (Cold Finished)	4Al-2Mo-1.6V-Fe-Si
54	ASTM	B 348	Grade 35	—	—	130/120 [896/827]	Rounds (Cold Finished)	4Al-2Mo-1.6V-Fe-Si
54	ASTM	B 348	Grade 35	—	—	130/120 [896/827]	Hexagons & Octagons (Hot Rolled)	4Al-2Mo-1.6V-Fe-Si
54	ASTM	B 348	Grade 35	—	—	130/120 [896/827]	Rounds & Squares (Hot Rolled)	4Al-2Mo-1.6V-Fe-Si
54	ASTM	B 348	Grade 35	—	—	130/120 [896/827]	Flat Bars (Hot Rolled)	4Al-2Mo-1.6V-Fe-Si
54	ASTM	B 363	WPT 23	R56402	—	120/110 [827/758]	Seamless & Welded Fittings	6Al-4V
54	ASTM	B 363	WPT 24	R56405	—	130/120 [896/827]	Seamless & Welded Fittings	6Al-4V-0.06Pd
54	ASTM	B 363	WPT 25	R56403	—	130/120 [896/827]	Seamless & Welded Fittings	6Al-4V-0.55Ni-0.06Pd
54	ASTM	B 367	Grade C-5	R56400	—	130/120 [896/827]	Castings (As-Cast)	6Al-4V
54	ASTM	B 367	Grade C-6	R54520	—	115/105 [793/724]	Castings (As-Cast)	5Al-2.5Sn
54	ASTM	B 381	F-5	R56400	—	130/120 [896/827]	Forgings	6Al-4V
54	ASTM	B 381	F-6	R54520	—	120/115 [827/793]	Forgings	5Al-2.5Sn
54	ASTM	B 381	F-23	R56402	—	120/110 [827/758]	Forgings	6Al-4V
54	ASTM	B 381	F-24	R56405	—	130/120 [896/827]	Forgings	6Al-4V-0.06Pd
54	ASTM	B 381	F-25	R56403	—	130/120 [896/827]	Forgings	6Al-4V-0.55Ni-0.06Pd
54	ASTM	B 861	Grade 5	R56400	—	130/120 [896/827]	Seamless Pipe	6Al-4V
54	ASTM	B 861	Grade 23	R56402	—	120/110 [827/758]	Seamless Pipe	6Al-4V(ELI)
54	ASTM	B 861	Grade 24	R56405	—	130/120 [896/827]	Seamless Pipe	6Al-4V-0.06Pd
54	ASTM	B 861	Grade 25	R56403	—	130/120 [896/827]	Seamless Pipe	6Al-4V-0.55Ni-0.06Pd
54	ASTM	B 861	Grade 29	R56404	—	120/110 [827/758]	Seamless Pipe	6Al-4V-0.11Pd(ELI)
54	ASTM	B 861	Grade 35	—	—	130/120 [896/827]	Seamless Pipe	4.5Al-2Mo-1.6V-0.5Fe-0.3Si
54	ASTM	B 862	Grade 5	R56400	—	130/120 [896/827]	Welded Pipe	6Al-4V
54	ASTM	B 862	Grade 23	R56402	—	120/110 [827/758]	Welded Pipe	6Al-4V(ELI)
54	ASTM	B 862	Grade 24	R56405	—	130/120 [896/827]	Welded Pipe	6Al-4V-0.06Pd
54	ASTM	B 862	Grade 25	R56403	—	130/120 [896/827]	Welded Pipe	6Al-4V-0.55Ni-0.06Pd

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Titanium and Titanium Base Alloys								
54	ASTM	B 862	Grade 29	R56404	—	120/110 [827/758]	Welded Pipe	6Al-4V-0.11Pd(ELI)
54	ASTM	B 862	Grade 35	—	—	130/120 [896/827]	Welded Pipe	4.5Al-2Mo-1.6V-0.5Fe-0.3Si
54	AMS	4915	8Al-1Mo-1V	R54810	≤0.187 [5]	145/135 [1000/931]	Sheet & Strip (Single Annealed)	8Al-1Mo-1V
54	AMS	4915	8Al-1Mo-1V	R54810	0.1875–0.500 [5–13]	145/135 [1000/931]	Plate (Single Annealed)	8Al-1Mo-1V
54	AMS	4915	8Al-1Mo-1V	R54810	0.501–1.000 [13–25]	140/130 [965/896]	Plate (Single Annealed)	8Al-1Mo-1V
54	AMS	4915	8Al-1Mo-1V	R54810	1.001–2.500 [25–64]	130/120 [896/827]	Plate (Single Annealed)	8Al-1Mo-1V
54	AMS	4915	8Al-1Mo-1V	R54810	2.501–4.000 [64–100]	120/110 [827/758]	Plate (Single Annealed)	8Al-1Mo-1V
54	AMS	4919	Al-Zr-Mo-Sn	R54620	—	135/125 [931/862]	Sheet (Duplex Annealed)	6Al-4Zr-2Mo-2Sn
54	AMS	4973	Al-Mo-V	R54810	≤2.500 [64]	130/120 [896/827]	Forgings (Solution Treated & Stabilized)	8Al-1Mo-1V
54	AMS	4973	Al-Mo-V	R54810	2.500–4.000 [64–100]	120/110 [827/758]	Forgings (Solution Treated & Stabilized)	8Al-1Mo-1V
54	AMS	4975	Al-Zr-Mo-Sn	R54620	—	130/120 [896/827]	Bar (Solution Treated, Duplex Annealed)	6Al-4Zr-2Mo-2Sn
54	AMS	4976	Al-Zr-Mo-Sn	R54620	—	130/120 [896/827]	Forging, STA (Duplex Annealed)	6Al-4Zr-2Mo-2Sn

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Zirconium and Zirconium Base Alloys								
61	ASTM	B 351	R60001	R60001	—	42/20 [290/138]	Bars—Round, Square & Hexagon	99.9minZr
61	ASTM	B 351	R60001	R60001	—	42/20 [290/138]	Flat Bars	99.9minZr
61	ASTM	B 351	R60001	R60001	—	42/20 [290/138]	Rod	99.9minZr
61	ASTM	B 351	R60001	R60001	—	42/20 [290/138]	Wire	99.9minZr
61	ASTM	B 351	R60802	R60802	—	60/35 [414/241]	Bars—Round, Square & Hexagon	98Zr-1.45Sn-0.28(Fe+Ni+Cr)
61	ASTM	B 351	R60802	R60802	—	60/35 [414/241]	Flat Bars	98Zr-1.45Sn-0.28(Fe+Ni+Cr)
61	ASTM	B 351	R60802	R60802	—	60/35 [414/241]	Rod	98Zr-1.45Sn-0.28(Fe+Ni+Cr)
61	ASTM	B 351	R60802	R60802	—	60/35 [414/241]	Wire	98Zr-1.45Sn-0.28(Fe+Ni+Cr)
61	ASTM	B 351	R60804	R60804	—	60/35 [414/241]	Bars—Round, Square & Hexagon	98.2Zr-1.5Sn-0.32(Fe+Cr)
61	ASTM	B 351	R60804	R60804	—	60/35 [414/241]	Flat Bars	98.2Zr-1.5Sn-0.32(Fe+Cr)
61	ASTM	B 351	R60804	R60804	—	60/35 [414/241]	Rod	98.2Zr-1.5Sn-0.32(Fe+Cr)
61	ASTM	B 351	R60804	R60804	—	60/35 [414/241]	Wire	98.2Zr-1.5Sn-0.32(Fe+Cr)
61	ASTM	B 352	R60001	R60001	<3/16 [5]	42/20 [290/138]	Sheet & Strip	99.9minZr
61	ASTM	B 352	R60001	R60001	≥3/16 [5]	42/20 [290/138]	Plate	99.9minZr
61	ASTM	B 352	R60802	R60802	<3/16 [5]	58/35 [400/241]	Sheet & Strip	98Zr-1.45Sn-0.28(Fe+Ni+Cr)
61	ASTM	B 352	R60802	R60802	≥3/16 [5]	58/35 [400/241]	Plate	98Zr-1.45Sn-0.28(Fe+Ni+Cr)
61	ASTM	B 352	R60804	R60804	<3/16 [5]	56/35 [386/241]	Sheet & Strip	98.2Zr-1.5Sn-0.32(Fe+Cr)
61	ASTM	B 352	R60804	R60804	≥3/16 [5]	58/35 [400/241]	Plate	98.2Zr-1.5Sn-0.32(Fe+Cr)
61	ASTM	B 353	R60001	R60001	—	42/20 [290/138]	Seamless & Welded Tube	99.9minZr
61	ASTM	B 353	R60802	R60802	—	60/35 [414/241]	Seamless & Welded Tube	98Zr-1.45Sn-0.28(Fe+Ni+Cr)
61	ASTM	B 353	R60804	R60804	—	60/35 [414/241]	Seamless & Welded Tube	98.2Zr-1.5Sn-0.32(Fe+Cr)
61	ASTM	B 493	R60702	R60702	—	55/30 [379/207]	Forgings	99.2min(Zr+Hf)
61	ASTM	B 493	R60704	R60704	—	60/35 [414/241]	Forgings	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
61	ASTM	B 523	R60702	R60702	—	55/30 [379/207]	Seamless & Welded Tube	99.2min(Zr+Hf)
61	ASTM	B 523	R60704	R60704	—	60/35 [414/241]	Seamless & Welded Tube	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
61	ASTM	B 550	R60702	R60702	—	55/30 [379/207]	Rounds (Cold Finished)	99.2min(Zr+Hf)
61	ASTM	B 550	R60702	R60702	—	55/30 [379/207]	Hex., Oct. & Squares (Cold Finished)	99.2min(Zr+Hf)

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Zirconium and Zirconium Base Alloys								
61	ASTM	B 550	R60702	R60702	—	55/30 [379/207]	Flat Bars (Cold Finished)	99.2min(Zr+Hf)
61	ASTM	B 550	R60702	R60702	—	55/30 [379/207]	Round & Square Wire	99.2min(Zr+Hf)
61	ASTM	B 550	R60702	R60702	—	55/30 [379/207]	Flat Bars (Hot Rolled)	99.2min(Zr+Hf)
61	ASTM	B 550	R60702	R60702	—	55/30 [379/207]	Drawn Hexagons & Octagons	99.2min(Zr+Hf)
61	ASTM	B 550	R60704	R60704	—	60/35 [414/241]	Flat Bars (Hot Rolled)	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
61	ASTM	B 550	R60704	R60704	—	60/35 [414/241]	Rounds (Cold Finished)	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
61	ASTM	B 550	R60704	R60704	—	60/35 [414/241]	Hex., Oct. & Squares (Cold Finished)	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
61	ASTM	B 550	R60704	R60704	—	60/35 [414/241]	Flat Bars (Cold Finished)	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
61	ASTM	B 550	R60704	R60704	—	60/35 [414/241]	Round & Square Wire	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
61	ASTM	B 550	R60704	R60704	—	60/35 [414/241]	Drawn Hexagons & Octagons	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
61	ASTM	B 551	R60702	R60702	<3/16 [5]	55/30 [379/207]	Sheet & Strip	99.2minZr
61	ASTM	B 551	R60702	R60702	≥3/16 [5]	55/30 [379/207]	Plate	99.2minZr
61	ASTM	B 551	R60704	R60704	<3/16 [5]	60/35 [414/241]	Sheet & Strip	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
61	ASTM	B 551	R60704	R60704	≥3/16 [5]	60/35 [414/241]	Plate	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
61	ASTM	B 658	R60702	R60702	—	55/30 [379/207]	Seamless & Welded Pipe	99.2min(Zr+Hf)
61	ASTM	B 658	R60704	R60704	—	60/35 [414/241]	Seamless & Welded Pipe	97.5min(Zr+Hf)-1.5Sn-0.3(Fe+Cr)
62	ASTM	B 351	R60901	R60901	—	65/45 [448/310]	Bars—Round, Square & Hexagon	97.3Zr-2.6Cb
62	ASTM	B 351	R60901	R60901	—	65/45 [448/310]	Flat Bars	97.3Zr-2.6Cb
62	ASTM	B 351	R60901	R60901	—	65/45 [448/310]	Rod	97.3Zr-2.6Cb
62	ASTM	B 351	R60901	R60901	—	65/45 [448/310]	Wire	97.3Zr-2.6Cb
62	ASTM	B 352	R60901	R60901	≥3/16 [5]	65/45 [448/310]	Sheet & Strip	97.3Zr-2.6Cb

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Zirconium and Zirconium Base Alloys								
62	ASTM	B 352	R60901	R60901	>3/16 [5]	65/45 [448/310]	Plate	97.3Zr-2.6Cb
62	ASTM	B 353	R60901	R60901	—	65/45 [448/310]	Seamless & Welded Tube	97.3Zr-2.6Cb
62	ASTM	B 353	R60904	R60904	—	65/45 [448/310]	Seamless & Welded Tube	97.35Zr-2.65Cb
62	ASTM	B 493	R60705	R60705	—	70/55 [483/379]	Forgings	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 523	R60705	R60705	—	80/55 [552/379]	Seamless & Welded Tube	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 550	R60705	R60705	—	80/55 [552/379]	Hex., Oct. & Squares (Cold Finished)	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 550	R60705	R60705	—	80/55 [552/379]	Flat Bars (Hot Rolled)	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 550	R60705	R60705	—	80/55 [552/379]	Rounds (Cold Finished)	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 550	R60705	R60705	—	80/55 [552/379]	Hex., Oct. & Squares (Cold Finished)	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 550	R60705	R60705	—	80/55 [552/379]	Flat Bars (Cold Finished)	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 550	R60705	R60705	—	80/55 [552/379]	Round & Square Wire	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 550	R60705	R60705	—	80/55 [552/379]	Drawn Hexagons & Octagons	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 551	R60705	R60705	—	80/55 [552/379]	Plate, Sheet & Strip	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 551	R60706	R60706	—	74/50 [510/345]	Plate, Sheet & Strip	95.5(Zr+Hf)-2.5Cb
62	ASTM	B 658	R60705	R60705	—	80/55 [552/379]	Seamless & Welded Pipe	95.5(Zr+Hf)-2.5Cb

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Magnesium and Magnesium Base Alloys								
81	ASTM	B 90	AZ31B (-O, H24, H26)	M11311	0.016–3.000 [0.40–80]	32/– [221/–]	Plate & Sheet	95.5Mg-3Al-1Zn
81	ASTM	B 90	AZ31C (-O, H24, H26)	M11312	0.016–0.060 [0.40–1.50]	32/18 [221/124]	Sheet	95.5Mg-3Al-1Zn
81	ASTM	B 90	AZ31C (-O, H24, H26)	M11312	0.061–3.000 [1.50–80]	32/15 [221/103]	Plate & Sheet	95.5Mg-3Al-1Zn
81	ASTM	B 90	HK31A (-O, H24)	M13310	0.016–0.500 [0.40–13]	30/16 [207/110]	Plate & Sheet	95.5Mg-3Al-1Zn
81	ASTM	B 90	HK31A (-O, H24)	M13310	0.501–1.000 [13–25]	30/15 [207/103]	Plate	95.5Mg-3Al-1Zn
81	ASTM	B 90	HK31A (-O, H24)	M13310	1.001–3.000 [25–80]	29/14 [200/97]	Plate	95.5Mg-3Al-1Zn
81	ASTM	B 90	ZE10A (-O)	M16100	0.016–0.060 [0.40–1.50]	30/18 [207/124]	Sheet	98Mg-1.25Zn-0.17Re
81	ASTM	B 90	ZE10A (-O)	M16100	0.061–0.250 [1.50–6.3]	30/15 [207/103]	Sheet	98Mg-1.25Zn-0.17Re
81	ASTM	B 90	ZE10A (-O)	M16100	0.251–0.500 [6.30–13]	29/12 [200/83]	Plate	98Mg-1.25Zn-0.17Re
81	ASTM	B 91	AZ31B (-F)	M11311	—	32/15 [221/103]	Forgings	95.5Mg-3Al-1Zn
81	ASTM	B 91	AZ61A (-F)	M11610	—	35/19 [241/131]	Forgings	92.5Mg-6Al-1Zn
81	ASTM	B 107	AZ31B (-F)	M11311	≤0.249 [6.30]	32/18 [221/124]	Extruded Bars, Rods, Profiles & Wires	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31B (-F)	M11311	0.250–1.499 [6.3–40]	32/19 [221/131]	Extruded Bars, Rods, Profiles & Wires	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31B (-F)	M11311	1.500–2.499 [40–60]	31/19 [214/131]	Extruded Bars, Rods, Profiles & Wires	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31B (-F)	M11311	2.500–4.999 [60–130]	29/17 [200/117]	Extruded Bars, Rods, Profiles & Wires	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31B (-F)	M11311	—	29/13 [200/90]	Extruded Hollow Profiles	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31B (-F)	M11311	0.028–0.250 [0.70–6.3]	29/17 [200/117]	Extruded Tubes	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31B (-F)	M11311	0.251–0.750 [6.30–20]	29/13 [200/90]	Extruded Tubes	95.5Mg-3Al-1Zn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Magnesium and Magnesium Base Alloys								
81	ASTM	B 107	AZ31C (-F)	M11312	≤0.249 [6.30]	32/18 [221/124]	Extruded Bars, Rods, Profiles & Wires	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31C (-F)	M11312	0.250–1.499 [6.3–40]	32/19 [221/131]	Extruded Bars, Rods, Profiles & Wires	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31C (-F)	M11312	1.500–2.499 [40–60]	31/19 [214/131]	Extruded Bars, Rods, Profiles & Wires	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31C (-F)	M11312	2.500–4.999 [60–130]	29/17 [200/117]	Extruded Bars, Rods, Profiles & Wires	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31C (-F)	M11312	—	29/13 [200/90]	Extruded Hollow Profiles	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31C (-F)	M11312	0.028–0.250 [0.70–6.3]	29/17 [200/117]	Extruded Tubes	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ31C (-F)	M11312	0.251–0.750 [6.30–20]	29/13 [200/90]	Extruded Tubes	95.5Mg-3Al-1Zn
81	ASTM	B 107	AZ61A (-F)	M11610	≤0.249 [6.30]	35/18 [241/124]	Extruded Bars, Rods, Profiles & Wires	92.5Mg-6.5Al-1Zn
81	ASTM	B 107	AZ61A (-F)	M11610	0.250–2.499 [6.3–60]	37/21 [255/145]	Extruded Bars, Rods, Profiles & Wires	92.5Mg-6.5Al-1Zn
81	ASTM	B 107	AZ61A (-F)	M11610	2.500–4.999 [60–130]	37/19 [255/131]	Extruded Bars, Rods, Profiles & Wires	92.5Mg-6.5Al-1Zn
81	ASTM	B 107	AZ61A (-F)	M11610	—	33/13 [228/90]	Extruded Hollow Profiles	92.5Mg-6.5Al-1Zn
81	ASTM	B 107	AZ61A (-F)	M11610	0.028–0.750 [0.70–20]	33/13 [228/90]	Extruded Tubes	92.5Mg-6.5Al-1Zn
81	ASTM	B 107	M1A (-F)	M15100	≤0.249 [6.30]	27/– [186/–]	Extruded Bars, Rods, Profiles & Wires	98Mg-1.6Mn
81	ASTM	B 107	M1A (-F)	M15100	0.250–2.499 [6.3–60]	29/– [200/–]	Extruded Bars, Rods, Profiles & Wires	98Mg-1.6Mn
81	ASTM	B 107	M1A (-F)	M15100	2.500–4.999 [60–130]	26/– [179/–]	Extruded Bars, Rods, Profiles & Wires	98Mg-1.6Mn
81	ASTM	B 107	M1A (-F)	M15100	—	25/– [172/–]	Extruded Hollow Profiles	98Mg-1.6Mn
81	ASTM	B 107	M1A (-F)	M15100	0.028–0.750 [0.70–20]	25/– [172/–]	Extruded Tubes	98Mg-1.6Mn
83	ASTM	B 80	AZ91C (-F)	M11914	—	21/10 [145/69]	Sand Castings	90.5Mg-8.7Al-0.7Zn-0.2Mn
83	ASTM	B 80	AZ92A (-F)	M11920	—	21/10 [145/69]	Sand Castings	88.5Mg-9Al-2Zn

(Continued)

Table D.2 (Continued)
M-Number Listing of Base Metals—Nonferrous Alloys

Material Number	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Thickness or Diameter Limitations, in [mm]	Minimum Tensile/Yield Strength, ksi [MPa]	Product Form	Nominal Composition
Magnesium and Magnesium Base Alloys								
83	ASTM	B 80	K1A (-F)	M18010	—	22/5 [152/34]	Sand Castings	99.3Mg-0.6Zr
83	ASTM	B 199	AM100A (-F)	M10100	—	18/9 [124/62]	Permanent Mold Casting	89.5Mg-10Al-0.2Mn
83	ASTM	B 199	AZ91C (-F)	M11914	—	21/10 [145/69]	Permanent Mold Casting	90.5Mg-8.7Al-0.7Zn-0.2Mn
83	ASTM	B 199	AZ92A (-F)	M11920	—	21/10 [145/69]	Permanent Mold Casting	88.5Mg-9Al-2Zn
83	ASTM	B 403	AM100A (-F)	M10100	—	18/9 [124/62]	Investment Castings	89.5Mg-10Al-0.2Mn
83	ASTM	B 403	AZ91C (-F)	M11914	—	16/9 [110/62]	Investment Castings	90.5Mg-8.7Al-0.7Zn-0.2Mn
83	ASTM	B 403	AZ92A (-F)	M11920	—	18/9 [124/62]	Investment Castings	88.5Mg-9Al-2Zn
83	ASTM	B 403	K1A (-F)	M18010	—	22/5 [152/34]	Investment Castings	99.3Mg-0.6Zr

Table D.3
Listing of Base Metal Specifications—Iron Castings

AWS D11.2 Group	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Minimum As-Welded Tensile/Yield Strength, ksi [MPa]	Type of Base Metal	Nominal Composition
Iron Castings^{a, b}							
A	ASTM	A 48	Class 20	F11401	20/– [138/–]	Gray Cast Iron	Not Specified
A	ASTM	A 48	Class 25	F11701	25/– [172/–]	Gray Cast Iron	Not Specified
A	ASTM	A 48	Class 30	F12101	30/– [207/–]	Gray Cast Iron	Not Specified
A	ASTM	A 48	Class 35	F12401	35/– [241/–]	Gray Cast Iron	Not Specified
A	ASTM	A 48	Class 40	F12801	40/– [276/–]	Gray Cast Iron	Not Specified
A	ASTM	A 48	Class 45	F13101	45/– [310/–]	Gray Cast Iron	Not Specified
A	ASTM	A 48	Class 50	F13501	50/– [345/–]	Gray Cast Iron	Not Specified
A	ASTM	A 48	Class 55	F13801	55/– [379/–]	Gray Cast Iron	Not Specified
A	ASTM	A 48	Class 60	F14101	60/– [414/–]	Gray Cast Iron	Not Specified
A	ASTM	A 74	Class A	—	21/– [145/–]	Gray Cast Iron	0.75 Max.P, 0.15 Max.S
A	ASTM	A 126	Class A	F11501	21/– [145/–]	Gray Cast Iron	0.75 Max.P, 0.15 Max.S
A	ASTM	A 126	Class B	F12102	31/– [214/–]	Gray Cast Iron	0.75 Max.P, 0.15 Max.S
A	ASTM	A 126	Class C	F12103	41/– [283/–]	Gray Cast Iron	0.75 Max.P, 0.15 Max.S
A	ASTM	A 159	Grade 1800	F10004	18/– [124/–]	Gray Cast Iron	0.55Si-0.65Mn; 4.35CE
A	ASTM	A 159	Grade 2500	F10005	25/– [172/–]	Gray Cast Iron	2.2 Si-0.75Mn; 4.12CE
A	ASTM	A 159	Grade 2500a	F10009	25/– [172/–]	Gray Cast Iron	1.85Si-0.75Mn; 4.12 CE
A	ASTM	A 159	Grade 3000	F10006	30/– [207/–]	Gray Cast Iron	2.1Si-0.75Mn; 4.02CE
A	ASTM	A 159	Grade 3500	F10007	35/– [241/–]	Gray Cast Iron	2.0Si-0.75Mn; 3.8CE
A	ASTM	A 159	Grade 3500b	F10010	35/– [241/–]	Gray Cast Iron	1.55Si-0.75Mn; 3.8CE
A	ASTM	A 159	Grade 3500c	F10011	35/– [241/–]	Gray Cast Iron	1.55Si-0.75Mn; 3.8CE
A	ASTM	A 159	Grade 4000	F10008	40/– [276/–]	Gray Cast Iron	1.95Si-0.85Mn; 3.8CE
A	ASTM	A 159	Grade 4000d	F10012	40/– [276/–]	Gray Cast Iron	1.95Si-0.85Mn; 3.8CE
A	ASTM	A 319	Class I	F10001	25/– [172/–]	Gray Cast Iron	Not Specified
A	ASTM	A 319	Class II	F10002	30/– [207/–]	Gray Cast Iron	Not Specified
A	ASTM	A 319	Class III	F10003	40/– [276/–]	Gray Cast Iron	Not Specified
A	SAE	J431	G1800	F10004	18/– [124/–]	Gray Cast Iron	2.3Si-0.65Mn; 4.35CE
A	SAE	J431	G2500	F10005	25 [172]	Gray Cast Iron	2.3Si-0.75Mn; 4.12CE
A	SAE	J431	G3000	F10006	30 [207]	Gray Cast Iron	2.1Si-0.65Mn; 4.02CE
A	SAE	J431	G3500	F10007	35 [241]	Gray Cast Iron	2.0Si-0.75Mn; 3.8CE
A	SAE	J431	G4000	F10008	40 [276]	Gray Cast Iron	1.95Si-0.95Mn; 3.8CE
B	ASTM	A 536	100-70-03	F34800	100/70 [689/483]	Ductile	Not specified
B	ASTM	A 536	120-90-02	F36200	120/90 [827/621]	Ductile	Not specified
B	ASTM	A 536	60-40-18	F32800	60/40 [414/276]	Ductile	Not specified
B	ASTM	A 536	65-45-12	F33100	65/42 [448/290]	Ductile	Not specified
B	ASTM	A 536	80-55-06	F33800	80/55 [552/379]	Ductile	Not specified
B	ASTM	A 716	60-42-10	F32900	60/– [414/–]	Ductile	Not specified
B	ASTM	A 746	60-42-10	—	60/– [414/–]	Ductile	Not specified
B	ASTM	A 874	—	—	45/30 [310/207]	Ductile	3.35C-1.75Si
B	ASTM	A 897	125-80-10	—	125/80 [862/552]	Ductile	1.0Ni-0.5Cu-0.35Mn-0.015Mo

(Continued)

Table D.3 (Continued)
Listing of Base Metal Specifications—Iron Castings

AWS D11.2 Group	Standard	Base Metal Specification	Type, Grade, or Alloy Designation	UNS Number	Minimum As-Welded Tensile/Yield Strength, ksi [MPa]	Type of Base Metal	Nominal Composition
Iron Castings^{a, b}							
B	SAE	J434	D4018	F32800	60/– [414/–]	Ductile	Not specified
B	SAE	J434	D4512	F33100	65/– [448/–]	Ductile	Not specified
B	SAE	J434	D5506	F33800	80/– [552/–]	Ductile	Not specified
B	SAE	J434	D7003	F34800	100/– [689/–]	Ductile	Not specified
C	ASTM	A 47	32510	F22200	50/– [345/–]	Malleable	Not Specified
C	ASTM	A 47	35018	F22400	53/– [365/–]	Malleable	Not Specified
C	ASTM	A 197	—	F22200	40/– [276/–]	Malleable	Not Specified
C	ASTM	A 220	40010	F22830	60/– [414/–]	Malleable	Not Specified
C	ASTM	A 220	45006	F23131	65/– [448/–]	Malleable	Not Specified
C	ASTM	A 220	45008	F23130	65/– [448/–]	Malleable	Not Specified
C	ASTM	A 220	50005	F23530	70/– [483/–]	Malleable	Not Specified
C	ASTM	A 220	60004	F24130	80/– [552/–]	Malleable	Not Specified
C	ASTM	A 220	70003	F24830	85/– [586/–]	Malleable	Not Specified
C	ASTM	A 220	80002	F25530	95/– [655/–]	Malleable	Not Specified
C	ASTM	A 220	90001	F26230	105/– [724/–]	Malleable	Not Specified
C	ASTM	A 602	M3210	F20000	50/– [345/–]	Malleable	Not Specified
C	ASTM	A 602	M4504	F20000	65/– [448/–]	Malleable	Not Specified
C	ASTM	A 602	M5003	F20000	75/– [517/–]	Malleable	Not Specified
C	SAE	J158a	M3210	F20000	50/– [345/–]	Malleable	Not Specified
C	SAE	J158a	M4504	F20001	65/– [448/–]	Malleable	Not Specified

^a In the absence of an M number to group the alloys, a separate procedure qualification is required for each group of the above materials.

^b The groups are based on AWS D11.2.

Annex E (Normative)

Radiographic Examination Procedure

This annex is part of AWS B2.1/B2.1M:2009-ADD1, *Specification for Welding Procedure and Performance Qualification*, and includes mandatory elements for use with this standard.

E1. General

E1.1 This procedure defines requirements for radiographic examination of those qualification test weldments specified to have radiographic examination.

E2. Radiographic Procedure

E2.1 Radiographs shall be made by either x-rays or other high-energy radiation source methods. Film shall be clean and free of artifacts and film processing defects in the area of interest. Unless otherwise specified in the Referencing Document, radiography shall be performed in accordance with ASME *Boiler and Pressure Vessel Code*, Section V, Article 2, or ASTM E 94, *Standard Guide for Radiographic Testing*. As a minimum the film shall contain:

(1) The welder's name or identification number and the WPS number, or alternatively, a test number may be used if traceable to the required data.

(2) The radiograph shall be within the required film density. When multiple radiographs are required to cover the weld, markers shall be used to indicate the location that each radiograph covers.

E2.2 Radiography shall be performed in accordance with all applicable safety requirements.

E2.3 Penetrators shall conform to the requirements of ASTM E 94, *Standard Guide for Radiographic Testing*, or ASTM E 747, *Standard Practice for Design, Manufacture and Material Grouping Classification of Wire Image Quality Indicators (IQI) Used for Radiology*. Alternatively, hole type or wire penetrators may

conform to ASME *Boiler and Pressure Vessel Code*, Section V.

E2.4 Weld reinforcement may be removed at the Qualifier's option, except that root reinforcement shall not be removed from single-welded joints with a groove weld. Backing shall not be removed. Shims of material that is radiographically similar to the base metal shall be placed under penetrameters so that the total thickness of material between the penetrometer and the film is at least equal to the average thickness of the base metal plus weld reinforcement and backing.

Radiographs shall be made with a single source of radiation centered approximately over the weld. The perpendicular distance from the radiation source to the film shall be not less than seven times the maximum thickness of the base metal plus weld reinforcement and backing. The film, during exposure, shall be as close to the weld surface opposite the source of radiation as possible.

E3. Personnel Requirements

Personnel performing radiography shall be qualified in accordance with ASNT SNT-TC-1A or equivalent. Acceptance of radiographs shall be the responsibility of the Qualifier.

E4. Acceptance Criteria

The entire weld, except for the discard on plate, shall be examined.

E4.1 When the qualification test is a Standard Test Weldment, a minimum of 6 in [152 mm] of weld length shall be examined, except that for pipe the entire weld shall be examined. Multiple welds may be required for

small diameter test weldments to permit an examination of 6 in [152 mm] of weld. No more than four joints need be examined to meet this requirement.

E4.2 When qualification is based upon a production weldment the criteria for acceptance of the weld shall be as required by the Referencing Document. The criteria for acceptance of the welder or welding operator shall be in accordance with the acceptance criteria of **E4.4**. The extent of the examination shall be in accordance with **Clause E4** and **E4.1**, except that for operators, the minimum length of weld examined shall be 3 ft [1 m].

E4.3 Face reinforcement may be removed at the option of the Qualifier. Root reinforcement or backing strips shall not be removed from single-welded groove joints.

E4.4 Acceptance shall be in accordance with the following requirements.

(1) There shall be no cracks, incomplete joint penetration, or incomplete fusion. Root concavity in the test weldment is permitted, provided the film density through the weld is not less than that through the base metal.

(2) Acceptable linear indications shall be as shown in **Table E.1**. Linear discontinuities are those in which the length is more than three times the width.

(3) Acceptable rounded indications shall be as shown in **Table E.2** and **Figure E.1**. Rounded discontinuities are those having a length less than three times the width and may be circular, elliptical, or irregular in shape.

Table E.1
Acceptable Linear Discontinuities for Radiographic Examination

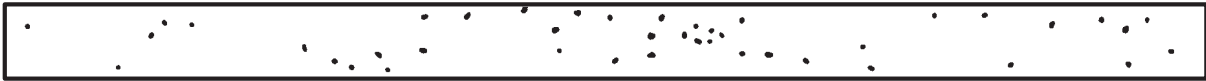
Weld Metal Thickness (t), in [mm]	Maximum Discontinuity, in [mm]	Maximum Aggregate Length Aligned Indications ^a
Up to 3/8 [9.5] inclusive	1/8 [3.2]	t in a length of 12t
Over 3/8 to 2-1/4 [9.5 to 57]	1/3t	t in a length of 12t
Over 2-1/4 [57]	3/4 [19]	t in a length of 12t

^a Aligned indications are those where the distance between the successive indications is less than 6L, where L is the length of the longest indication in the group.

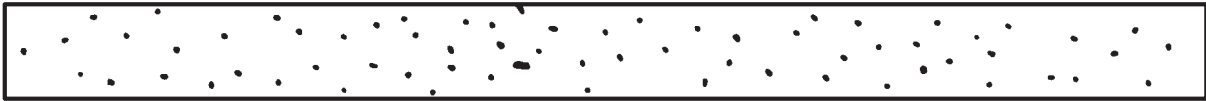
Table E.2
Acceptable Rounded Discontinuities for Radiographic Examination

Weld Metal Thickness (t), in [mm]	Maximum Acceptable Discontinuities	
	Single	Multiple
Less than 1/8 [3.2]	20% of t	A maximum of 12 acceptable indications in 6 in [150 mm] of weld
1/8 [3.2] or thicker ^a	The less of 20% of t or 1/8 in [3.2 mm]	Per chart Figure E.1

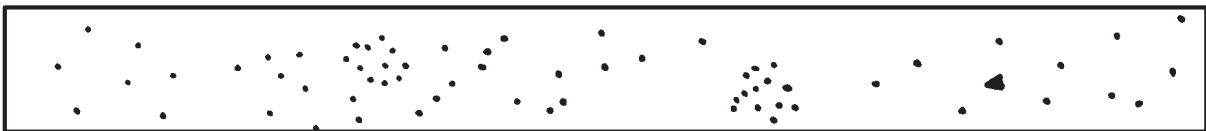
^a Rounded indications less than 1/32 in [0.8 mm] maximum diameter shall not be considered in this thickness range. Root concavity is permitted provided the film density through the area of interest is not less than that through the base metal.



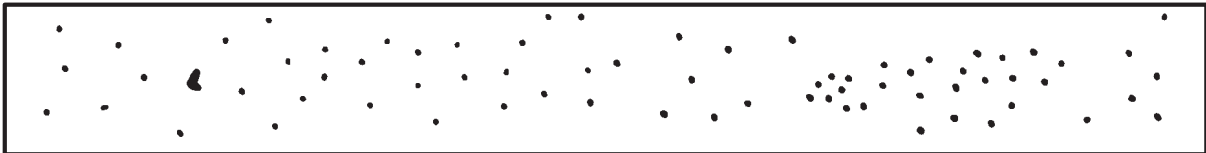
TYPICAL QUANTITY AND SIZE PERMITTED IN 6 in [125 mm]
 LENGTH OF WELD 1/8 in TO 1/4 in [3 mm TO 6 mm] THICKNESS



TYPICAL QUANTITY AND SIZE PERMITTED IN 6 in [125 mm]
 LENGTH OF WELD OVER 1/4 in TO 1/2 in [6 mm TO 13 mm] THICKNESS



TYPICAL QUANTITY AND SIZE PERMITTED IN 6 in [152 mm]
 LENGTH OF WELD OVER 1/2 in TO 1 in [13 mm TO 25 mm] THICKNESS



TYPICAL QUANTITY AND SIZE PERMITTED IN 6 in [152 mm]
 LENGTH OF WELD OVER 1 in [25 mm] THICKNESS

Figure E.1—Rounded Indication Charts for Radiographic Examination

This page is intentionally blank.

Annex F (Informative)

Sample Forms

This annex is not part of AWS B2.1/B2.1M:2009-ADD1, *Specification for Welding Procedure and Performance Qualification*, but is included for informational purposes only.

F1. General

The qualification tests for each welder or welding operator shall be documented by the Qualifier for both acceptable and unacceptable tests. There is no required format

for Welding Procedure Specifications (WPSs), Procedure Qualification Records (PQRs), and Performance Qualification Test Records (PQTRs). Any form may be used. Examples of forms for documenting qualification tests appear as Figures F.1 through F.5.

SAMPLE PERFORMANCE QUALIFICATION TEST RECORD

(SMAW, GMAW, GTAW, FCAW, SAW, OFW, PAW)

Name _____		Welder ☐ Welding Operator ☐		Test Joint Sketch
ID No. _____		WPS Used _____		
Process(es) _____		Transfer Mode (GMAW) _____		
Test Base Metal Specification _____		To _____		
Material Number _____		To _____		
Fuel Gas (OFW) _____		F No. _____		
AWS Filler Metal Classification(s) _____		Double Side ☐ Single Side ☐		
Backing: Yes ☐ No ☐		Backing Gas: Yes ☐ No ☐		
Current/Polarity: AC ☐ DCEP ☐ DCEN ☐				
Consumable Insert: Yes ☐ No ☐				

Test Weldment	Position Tested	Weldment Thickness (T)
Groove: Pipe	1G 2G 5G 6G	Thickness _____ Diameter _____
Plate	1G 2G 3G 4G	Thickness _____
Fillet: Pipe	1F 2F 2FR 4F 5F	Thickness _____ Diameter _____
Plate	1F 2F 3F 4F	Thickness _____
Cladding:	1C 2C 3C 4C 5C 6C	Thickness _____
Hardfacing:	1C 2C 3C 4C 5C 6C	Thickness _____
Progression:	Vertical Up ☐ Vertical Down ☐	

Test Results	Remarks
Visual Test: Pass ☐ Fail ☐ N/A ☐	_____
Bend Test: Pass ☐ Fail ☐ N/A ☐	_____
Macro Test: Pass ☐ Fail ☐ N/A ☐	_____
Break Test: Pass ☐ Fail ☐ N/A ☐	_____
Radiographic Test: Pass ☐ Fail ☐ N/A ☐	_____

Qualification Limits	
Process(es) _____	

Weldment	Position	Deposit Thickness	
Groove: Pipe	F H V O All	t min. _____ t max. _____	Dia. min. _____
Plate	F H V O All	t min. _____ t max. _____	
Cladding:	F H V O All	t min. _____ t max. _____	
Hardfacing:	F H V O All	t min. _____ t max. _____	

Fillet:	Position	Base Metal Thickness	
Pipe	F H V O All	T min. _____ T max. _____	Dia. min. _____
Plate	F H V O All	T min. _____ T max. _____	

Progression: Vertical Up ☐ Vertical Down ☐	
Base Metal M No(s). _____	Fuel Gas (OFW) _____
Filler Metal F No(s). _____	Backing: Yes ☐ No ☐
Current/Polarity: AC ☐ DCEP ☐ DCEN ☐	Consumable Insert: Yes ☐ No ☐
Backing Gas _____	Transfer Mode (GMAW) _____

I certify that the statements in this record are correct and the test welds were prepared, welded, and tested in accordance with the requirements of AWS B2.1/B2.1M, (_____), *Specification for Welding Procedure and Performance Qualification*.
(year)

Date Tested _____ Qualifier Signature _____

Permission to reproduce granted by the American Welding Society.

Figure F.1—Example of a Performance Qualification Test Record

SAMPLE WELDING PROCEDURE SPECIFICATION (WPS)

for SAW, SMAW, GMAW, GTAW, FCAW

Company _____ Approved by _____
 (Signature Required)
 WPS No. _____ Date _____
 WPS Revision No. _____ Rev. Date _____
 Supporting PQR Nos. _____
 Welding Process(es) _____ Type(s) _____
 (Manual, Semiautomatic, Automatic, Robotic, Mechanized)

Joints (see 4.13.1)

Joint Type _____
 Backing _____
 Backing Material (Type) _____
 Groove Angle _____
 Root Opening Radius: U ☐ J ☐
 Root Face _____
 Backgouging: Yes ☐ No ☐
 Backgouging Method _____

Joint Details

Sketches, production drawings, welding symbols, or written description should show the general arrangement of the parts to be welded. Where applicable, the root details of the weld groove may be specified.

Base Metals (see 4.13.2)

M-No. _____ Group No. _____ or to M-No. _____ Group No. _____
 Specification Type and Grade _____ to Specification Type and Grade _____
 Thickness Range of Base Metal: Groove _____ Fillet _____
 Deposited Metal: Groove _____ Fillet _____
 Pipe Diameter Range: Groove _____ Fillet _____
 Other _____

Filler Metals (see 4.13.3)

Filler Metal F-No. _____ Other _____
 AWS Classification _____ AWS Specification _____
 Weld Metal Analysis A-No. _____ Other _____
 Filler Metal Size _____ Electrode Flux (Class) _____
 Weld Metal Thickness _____ Flux Trade Name _____
 Consumable Insert _____ Other _____

Positions (see 4.13.4)

Position(s) of Groove _____
 Position(s) of Fillet _____
 Weld Progression _____

Preheat (see 4.13.5)

Preheat Temperature (Min.) _____
 Preheat Maintenance _____
 Interpass Temperature (Max.) _____
 Continuous or Special Heating or Maintenance: _____

PWHT (see 4.13.6)

Temperature _____
 Time _____

Figure F.2—Example of a Welding Procedure Specification

Shielding (see 4.13.7)

	Torch Shielding	Root Shielding	Trailing	Environmental Shielding
Gas(es)				
Composition				
Flow Rate				

Electrical Characteristics (see 4.13.8)

Current Type/Polarity _____
Pulsing: Yes ☐ No ☐
Current (Range) _____
Voltage (Range) _____
Wire Feed Speed (Range) _____
Tungsten Electrode Size/Type _____
Pulsing Parameters _____
Transfer Mode _____
Other _____

Other Variables (see 4.13.9)

Cup or Nozzle Size _____
Collet Body ☐ or Glass Lens ☐
Cleaning Method _____
Technique: Stringer ☐ or Weave Bead ☐
Cleaning Method _____
Number of Electrodes _____
Single ☐ or Multipass ☐
Contact Tip to Work Distance _____
Other _____

Welding Parameters

Layers	Process	Filler Metal		Electrical			Travel Speed Range
		Class	Diameter	Type and Polarity	Current Range	Voltage Range	

We, the undersigned, certify that the statements in this record are correct and the test welds were prepared, welded, and tested in accordance with the requirements of AWS B2.1/B2.1M, (_____), *Specification for Welding Procedure and Performance Qualification*.
(year)

Manufacturer or Contractor _____

Date _____ By _____
(Please Print) (Signature Required)

Permission to reproduce granted by the American Welding Society.

Figure F.2 (Continued)—Example of a Welding Procedure Specification

SAMPLE PROCEDURE QUALIFICATION RECORD (PQR)

for SAW, SMAW, GMAW, GTAW, FCAW

Company _____ Approved by _____
(Signature Required)

PQR No. _____ Date _____

Welding Process(es) _____ Type(s) _____
(Manual, Semiautomatic, Automatic, Robotic, Mechanized)**Joints (see 4.14.1)**

Joint Type _____

Backing _____

Backing Material (Type) _____

Groove Angle _____

Root Opening Radius: U ☐ J ☐

Root Face _____

Backgouging: Yes ☐ No ☐

Backgouging Method _____

Joint Details

Sketches, production drawings, welding symbols, or written description should show the general arrangement of the parts to be welded. Where applicable, the root details of the weld groove may be specified.

Base Metals (see 4.14.2)

M-No. _____ Group No. _____ or to M-No. _____ Group No. _____

Specification Type and Grade _____ to Specification Type and Grade _____

Thickness Range of Base Metal: Groove _____ Fillet _____

Pipe Diameter Range: Groove _____ Fillet _____

Other _____

Filler Metals (see 4.14.3)

Filler Metal F-No. _____ Other _____

AWS Classification _____ AWS Specification _____

Weld Metal Analysis A-No. _____ Other _____

Filler Metal Size _____ Electrode Flux (Class) _____

Weld Metal Thickness _____ Flux Trade Name _____

Consumable Insert _____ Other _____

Positions (see 4.14.4)

Position(s) of Groove _____

Position(s) of Fillet _____

Weld Progression _____

Preheat (see 4.14.5)

Preheat Temperature (Min.) _____

Temperature (Max.) _____

PWHT (see 4.14.6)

Temperature _____ Time _____

Shielding (see 4.14.7)

	Torch Shielding	Root Shielding	Trailing	Environmental Shielding
Gas(es)				
Composition				
Flow Rate				

Figure F.3—Example of a Procedure Qualification Record

**Electrical Characteristics and Welding Parameters
(see 4.13.8)**

Current Type/Polarity _____
 Pulsing: Yes ☐ No ☐
 Current (Range) _____
 Voltage (Range) _____
 Wire Feed Speed (Range) _____
 Travel Speed (Range) _____
 Tungsten Electrode Size/Type _____
 Transfer Mode _____
 Pulsing Parameters _____
 Heat Input _____
 Other _____

Other Variables (see 4.14.9)

Cup or Nozzle Size _____
 Collet Body ☐ or Glass Lens ☐
 Cleaning Method _____
 Technique: Stringer ☐ or Weave Bead ☐
 Number of Electrodes _____
 Number of Passes per Side _____
 Other _____

Test Results

Visual Test Results _____

Tensile Results

Specimen No.	Width	Thickness	Area	Results				Failure Type and Location
				Yield Load	Yield Strength	Tensile Load	Tensile Strength	

Guided Bend Tests	Qualification Results for Toughness Application
Type and Figure Number	Type and Figure Number
Results	Results

Fillet Weld Tests	Other Tests
Type and Figure Number	Type and Figure Number
Results	Results

We, the undersigned, certify that the statements in this record are correct and the test welds were prepared, welded, and tested in accordance with the requirements of AWS B2.1/B2.1M, (_____), *Specification for Welding Procedure and Performance Qualification*.
 (year)

Manufacturer or Contractor _____

Date _____ By _____
 Please Print Signature Required

Permission to reproduce granted by the American Welding Society.

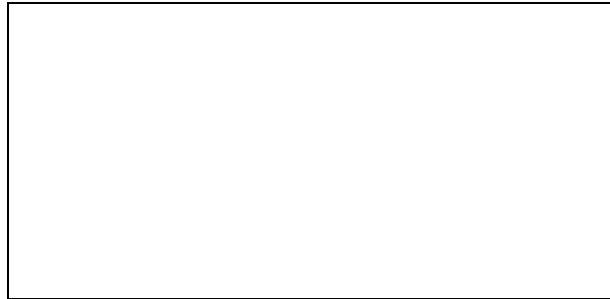
Figure F.3 (Continued)—Example of a Procedure Qualification Record

STUD WELDING PROCEDURE SPECIFICATION (WPS) Yes ☐
OR PROCEDURE QUALIFICATION RECORD (PQR) Yes ☐
OR WELDER QUALIFICATION RECORD (WQR) Yes ☐

Company name _____
 Supporting PQR no.(s) _____
 Operator name _____
 Stud material _____
 Material specifications _____
 Weld base diameter _____

Test no. _____
 Revision no. _____ Date _____
 By _____
 Authorized by _____ Date _____

Stud Base Sketch/Application Detail



Machine data

Power supply _____
 Make _____ Model _____
 Stud gun model _____
 Weld time Secs. _____ Cycles _____
 Current _____ $\pm 5\%$ OCV _____
 Polarity _____ Lift _____
 Plunge (protrusion) _____
 Weld cable size _____ Length _____
 Number of grounds (workpiece leads) _____

Base material

Specification _____
 Alloy and temper _____
 Group no. _____ Surface condition HR ☐ CR ☐
 Coating _____
 Cleaning method _____
 Decking gage _____

Shape

Flat ☐ Round ☐ Tube ☐ Angle ☐
 Thickness _____

Ferrule

Part no. _____
 Ferrule description _____

Position

Overhead _____ Downhand _____ Sidehand _____
 Angular _____ degrees from normal
 Angle iron _____ Inside radius _____ Heel of angle _____

Shielding gas

Shielding gas(es) _____
 Composition _____
 Flow rate _____

WELD TEST RESULTS

Stud No.	Visual Acceptance	Option #1 Bend Test	Option #2 Tension Test	Option #3 Torque Test*
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

*Note: Torque test optional for threaded fasteners only.

Mechanical tests conducted by _____ Date _____
 (Company)

We, the undersigned, certify that the statements in this record are correct and the test welds were prepared, welded, and tested in accordance with the requirements of AWS B2.1/B2.1M, (_____), *Specification for Welding Procedure and Performance Qualification*.
 (year)

Signed by _____ Title _____ Date _____
 (Contractor/Applicator)

Source: Adapted from AWS D1.1/D1.1M:2008, *Structural Welding Code—Steel*, Annex N Form N-9, American Welding Society.

**Figure F.4—Example of a Welding Procedure Specification
and Procedure Qualification Record for Stud Welding**

WPS QUALIFICATION TEST RECORD FOR ELECTROSLAG AND ELECTROGAS WELDING

PROCEDURE SPECIFICATION

Material specification _____
 Welding process _____
 Position of welding _____
 Filler metal specification _____
 Filler metal classification _____
 Filler metal _____
 Flux _____
 Shielding gas _____ Flow rate _____
 Gas dew point _____
 Thickness range this test qualifies _____
 Single or multiple pass _____
 Single or multiple arc _____
 Welding current _____
 Preheat temperature _____
 Postheat temperature _____
 Welder's name _____
 Guide tube flex _____
 Guide tube composition _____
 Guide tube diameter _____
 Vertical rise speed _____
 Traverse length _____
 Traverse speed _____
 Dwell _____
 Type of molding shoe _____

VISUAL INSPECTION

Appearance _____
 Undercut _____
 Piping porosity _____
 Test date _____
 Witnessed by _____

TEST RESULTS

Reduced-section tensile test

Tensile strength, psi

1. _____
2. _____

All-weld-metal tension test

Tensile strength, psi _____

Yield point/strength, psi _____

Elongation in 2 in, % _____

Side-bend tests

1. _____ 3. _____
2. _____ 4. _____

Radiographic-ultrasonic examination

RT report no. _____

UT report no. _____

Impact tests

Size of specimen _____ Test temp _____

Ft-lb: 1. _____ 2. _____ 3. _____ 4. _____

5. _____ 6. _____ Avg. _____

High _____ Low _____

Laboratory test no. _____

WELDING PROCEDURE

Pass No.	Electrode Size	Welding Current		Joint Detail
		Amperes	Volts	

We, the undersigned, certify that the statements in this record are correct and the test welds were prepared, welded, and tested in accordance with the requirements of AWS B2.1/B2.1M, (_____), *Specification for Welding Procedure and Performance Qualification*.
 (year)

Procedure no. _____

Manufacturer or Contractor _____

Revision no. _____

Authorized by _____

Date _____

Source: Adapted from AWS D1.1/D1.1M:2008, *Structural Welding Code—Steel*, Annex N Form N-3, American Welding Society.

**Figure F.5—Example of a Welding Procedure Specification
and Procedure Qualification Record for Electroslag and Electrogas Welding**

Annex G (Informative)

Macroetch Procedure

This annex is not part of AWS B2.1/B2.1M:2009-ADD1, *Specification for Welding Procedure and Performance Qualification*, but is included for informational purposes only.

G1. General

These procedures identify methods of macroetching specimens in preparation for macro-examination. The surfaces to be etched should be smoothed by filing, machining, or by grinding on emery paper. With different alloys, the etching period will vary from a few seconds to several minutes and should be continued until there is a clear definition of the macrostructure. After etching, the specimens should be thoroughly rinsed and then dried with a blast of warm air. Coating the surface with a thin, clear lacquer will preserve the appearance.

G2. Safety Procedures

G2.1 Chemical Etchants. All chemicals used as etchants are potentially hazardous. All persons using any etchant must be thoroughly familiar with all of the chemicals involved and the proper procedure for handling and mixing these chemicals.

G2.2 Handling and Mixing Acids. Precautions must be used in mixing all chemicals, especially strong acids. In all cases, chemicals should be added slowly **INTO** the water or solvent while stirring. **Never** add water to acid.

G2.3 Hydrofluoric Acid (HF). Hydrofluoric acid solutions should be mixed and used in polyethylene vessels.

G2.4 Basic Recommendations for Handling of Etching Chemicals. Protective clothing and equipment (gloves, apron, protective glasses or face shield, etc.) should always be used when pouring, mixing, or etching. Proper devices (glass or plastic) for weighing, mixing, containing, or storage of solutions should be used. All etching should be done under a fume hood. All spills should be wiped up or flushed immediately. Unidentified

solutions **SHOULD NOT** be used. When in doubt, the solutions should be disposed of in accordance with the existing environmental laws covering the disposal of chemicals or chemical solutions. Chemicals should be stored and handled according to manufacturer's recommendations, and users should read carefully and observe any printed precautions on chemical containers. When in doubt about the proper use of a chemical, refer to the Material Safety Data Sheet for that chemical or contact your Safety Department or the supplier of the chemicals.

G2.5 Disposal of Etchants. Chemicals should be disposed of in accordance with federal, state, and local regulations.

G3. Etching Solutions and Procedures

Caution: Review **B2 Safety Procedures** for safe practices.

The following etching solutions, together with directions for their use, are suggested as applicable for the material being etched:

G3.1 Carbon and Low-Alloy Steels. Three etchants are suggested for use on carbon steel. These are listed below along with mixing and usage instructions.

(1) *Nitric Acid.* One to ten percent nitric acid in water or alcohol (alcohol is preferred). The solution shall be used at room temperature and applied with a glass stirring rod.

(2) *Ammonium Persulfate.* One part of ammonium persulfate to nine parts of water by weight. The solution should be used at room temperature, and should be applied by vigorously rubbing the surface to be etched with a piece of cotton saturated with the solution.

(3) *Iodine and Potassium Iodide*. One part of powdered iodine, two parts of powdered potassium iodide, and ten parts of water, all by weight. The solution should be used at room temperature and applied by brushing.

G3.2 Stainless Steels. One etchant that is an effective macroetch for stainless steels is a ferric chloride, nitric acid, and water mixture. The solution contains:

Ferric chloride (FeCl_3)	200 g
Nitric acid (HNO_3)	300 mL
Water (H_2O)	100 mL

The solution should be used at room temperature and applied by swabbing.

G3.3 Aluminum and Aluminum Alloys. One etchant is suggested for use on metals of the aluminum family and their alloys. Its mix and use is provided below:

The following solution is to be used at room temperature. Etching is accomplished by either swabbing or immersing the specimen.

Hydrochloric acid (concentrated)	15 mL
Hydrofluoric acid (concentrated)	10 mL
Water	85 mL

G3.4 Copper and Copper Alloys. *Concentrated Nitric Acid* is recommended for etching the copper and copper-base alloys. The procedure for use is provided below:

Etching with the solution at room temperature is accomplished by either flooding or immersing the specimen for several seconds. After thorough rinsing with water, the process is repeated with a 50-50 solution of concentrated nitric acid and water. In the case of the silicon bronze alloys, it may be necessary to swab the surface with alcohol or water to remove a white (SiO_2) deposit.

G3.5 Nickel and Nickel-Base Alloys. Three etchants are suggested for use on nickel and nickel base alloys. These are listed below along with mixing and usage instructions.

G3.5.1 The following solution should be used on nickel, copper-nickel, nickel-chromium-iron, and nickel-copper material. The solution should be freshly mixed, and the specimen should be immersed for 30–120 seconds. The solution is mixed as follows:

- One part H_2O_2 (30%) hydrogen peroxide T
- Two parts HCl hydrochloric acid
- Three parts H_2O water

G3.5.2 The following solution called Lepito's etch is suitable for use on nickel, nickel-chromium-iron, or on

nickel-copper materials. It is applied by swabbing or immersion of the specimen. It is mixed as follows:

(1) *Solution #1*. 15 g of ammonium sulphate $(\text{HN}_4)_2\text{SO}_4$ is dissolved in 100 mL of water.

(2) *Solution #2*. 250 g of ferric chloride is dissolved in 100 mL of warm hydrochloric acid (concentrated).

(3) Solution #1 and #2 are then mixed and, after mixing, 30 mL of nitric acid (concentrated) is added. The resulting solution is Lepito's etch.

G3.5.3 The following etchant is used on nickel-chromium-molybdenum, nickel-chromium-molybdenum-iron, and nickel-molybdenum alloys. The solution should be freshly mixed, and the reaction time may be decreased by heating the specimen. The specimen should be immersed for 30–120 seconds. The solution contains the following:

- 1 part H_2O_2 (30%) hydrogen peroxide
- 4 parts HCl hydrochloric acid

G3.6 Titanium and Titanium Alloys. Two general purpose etchants are suggested for use on titanium and titanium alloys. These are the Kroll's and Keller's etches listed below. Both are applied at room temperature by swabbing or immersion of the specimen. The treatments are followed by a rinse in cold water.

(1) *Kroll's Etch*

Hydrofluoric acid (48%)	1 mL to 3 mL
Nitric acid (concentrated)	2 mL to 6 mL
Water	to make 100 mL

(2) *Keller's Etch*

Hydrofluoric acid (48%)	1/2 mL
Nitric acid (concentrated)	2-1/2 mL
Hydrochloric acid (concentrated)	1-1/2 mL
Water	to make 100 mL

G3.7 Zirconium and Zirconium Alloys. One etchant is suggested for use on the zirconium and zirconium alloy metals. The solution is shown below and is applied by either swabbing or immersion of the specimen.

Hydrofluoric acid (concentrated)	3 mL
Nitric acid (concentrated)	22 mL
Water	22 mL

Annex H (Informative)

Guidelines for the Preparation of Technical Inquiries

This annex is not part of AWS B2.1/B2.1M:2009-ADD1, *Specification for Welding Procedure and Performance Qualification*, but is included for informational purposes only.

H1. Introduction

The American Welding Society (AWS) Board of Directors has adopted a policy whereby all official interpretations of AWS standards are handled in a formal manner. Under this policy, all interpretations are made by the committee that is responsible for the standard. Official communication concerning an interpretation is directed through the AWS staff member who works with that committee. The policy requires that all requests for an interpretation be submitted in writing. Such requests will be handled as expeditiously as possible, but due to the complexity of the work and the procedures that must be followed, some interpretations may require considerable time.

H2. Procedure

All inquiries shall be directed to:

Managing Director
Technical Services Division
American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

All inquiries shall contain the name, address, and affiliation of the inquirer, and they shall provide enough information for the committee to understand the point of concern in the inquiry. When the point is not clearly defined, the inquiry will be returned for clarification. For efficient handling, all inquiries should be typewritten and in the format specified below.

H2.1 Scope. Each inquiry shall address one single provision of the standard unless the point of the inquiry involves two or more interrelated provisions. The provision(s) shall be identified in the scope of the inquiry

along with the edition of the standard that contains the provision(s) the inquirer is addressing.

H2.2 Purpose of the Inquiry. The purpose of the inquiry shall be stated in this portion of the inquiry. The purpose can be to obtain an interpretation of a standard's requirement or to request the revision of a particular provision in the standard.

H2.3 Content of the Inquiry. The inquiry should be concise, yet complete, to enable the committee to understand the point of the inquiry. Sketches should be used whenever appropriate, and all paragraphs, figures, and tables (or annex) that bear on the inquiry shall be cited. If the point of the inquiry is to obtain a revision of the standard, the inquiry shall provide technical justification for that revision.

H2.4 Proposed Reply. The inquirer should, as a proposed reply, state an interpretation of the provision that is the point of the inquiry or provide the wording for a proposed revision, if this is what the inquirer seeks.

H3. Interpretation of Provisions of the Standard

Interpretations of provisions of the standard are made by the relevant AWS technical committee. The secretary of the committee refers all inquiries to the chair of the particular subcommittee that has jurisdiction over the portion of the standard addressed by the inquiry. The subcommittee reviews the inquiry and the proposed reply to determine what the response to the inquiry should be. Following the subcommittee's development of the response, the inquiry and the response are presented to the entire committee for review and approval. Upon approval by the committee, the interpretation is an official

interpretation of the Society, and the secretary transmits the response to the inquirer and to the *Welding Journal* for publication.

H4. Publication of Interpretations

All official interpretations will appear in the *Welding Journal* and will be posted on the AWS web site.

H5. Telephone Inquiries

Telephone inquiries to AWS Headquarters concerning AWS standards should be limited to questions of a general nature or to matters directly related to the use of the standard. The *AWS Board Policy Manual* requires that all AWS staff members respond to a telephone request for an official interpretation of any AWS standard with the information that such an interpretation can be

obtained only through a written request. Headquarters staff cannot provide consulting services. However, the staff can refer a caller to any of those consultants whose names are on file at AWS Headquarters.

H6. AWS Technical Committees

The activities of AWS technical committees regarding interpretations are limited strictly to the interpretation of provisions of standards prepared by the committees or to consideration of revisions to existing provisions on the basis of new data or technology. Neither AWS staff nor the committees are in a position to offer interpretive or consulting services on (1) specific engineering problems, (2) requirements of standards applied to fabrications outside the scope of the document, or (3) points not specifically covered by the standard. In such cases, the inquirer should seek assistance from a competent engineer experienced in the particular field of interest.

Annex I (Informative)

Guidelines for Requesting Adoption of New Materials Under the AWS B2.1 Standard

This annex is not part of AWS B2.1/B2.1M:2009-ADD1, *Specification for Welding Procedure and Performance Qualification*, but is included for information purposes only.

I1. Introduction

AWS policy requires all requests to adopt materials for inclusion to be handled in a formal manner. Official communication concerning requests for material adoption is through the AWS staff member who works with that committee. The policy requires that all requests be submitted in writing. Requests will be handled as expeditiously as possible, but due to the complexity of the work and the procedures that must be followed, some requests may require considerable time.

It is the policy of the AWS B2 Committee to adopt for inclusion in the standard only such specifications as have been adopted by recognized national or international organizations. The committee will consider requests to adopt new materials only from other codes and standards, or fabricators and other end users. In addition, such requests should be for materials for which there is a reasonable expectation of use in AWS standards.

I2. Procedure

All requests for the adoption of materials or for extended coverage of existing materials must be directed to:

Managing Director
Technical Services Division
American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

All requests must contain the name, address, and affiliation of the inquirer, and they must provide the necessary information for the committee to consider the request.

I2.1 Scope. The inquiry shall identify the material or materials for which consideration is being requested and the AWS codes and standards for which the material is considered applicable. The inquirer shall identify the general usage of the material and the temperature range of the application. The inquirer shall also identify all product forms, size ranges, and specifications for which incorporation is desired.

I2.2 Content of the Inquiry. The inquiry should be concise, yet complete, addressing mechanical properties, weldability, and other pertinent information.

I2.2.1 Mechanical Properties. Together with the specification for the material, the inquirer shall furnish the committee with adequate data for inclusion in the applicable tables. The data shall include values of ultimate tensile strength, yield strength, reduction of area, and elongation. Any heat treatment that is required to produce the mechanical properties should be fully described.

The inquirer shall submit a proposed entry for Table D.2 of the standard. Note that the minimum tensile and yield strength values specified in Table D.2 are minimum welded values.

Fracture toughness data shall be provided for materials for which fracture toughness rules would be expected to apply. The data shall include test results for the intended lowest service metal temperature and for the range of material thicknesses desired. The fracture toughness data shall include the results of fracture toughness tests of weld heat-affected zones in the material.

I2.1.2 Weldability. The inquirer shall furnish complete data on the weldability of the proposed material, including data on procedure qualification tests made in

accordance with the requirements of recognized national or international organizations. Welding tests shall cover the full range of thickness in which the material is to be used. Data may be provided from documented references, standards, or codes.

12.1.3 Pertinent Information. The inquirer should provide any information that may affect the classification and use of the materials such as required heat treatments, susceptibility to air hardening, effect of welding procedure and heat-affected zone and weld metal fracture toughness, and the amount of experience with welding the material. Information describing service experience will be useful to the committee.

I3. Material Inquiry Checklist

To assist inquirers desiring the adoption of new materials of the extended coverage of existing materials, the committee provides the following summary of items that must be addressed for each inquiry. The committee reserves the right to request additional information.

- (1) Identification of the inquirer is required.
- (2) The material must be covered by a specification issued by a recognized national or international organization and an English language version must be provided.
- (3) The code or standard where the material is expected to be used shall be identified.
- (4) The material shall be defined as ferrous or nonferrous and the application must be identified (product forms, size range, and specification).
- (5) Mechanical property data must be submitted (ultimate tensile strength, yield strength, reduction of area, and elongation).
- (6) A proposed entry for Table D.2 of the standard shall be submitted. Note that the minimum tensile and yield strength values specified in Table D.2 are minimum welded values.
- (7) If applicable, appropriate fracture toughness data shall be submitted.

- (8) Procedure qualification test data or other supporting documentation shall be submitted.

I4. Publication of Adopted Material

Materials that are officially adopted for inclusion in the standard will appear online at <http://www.aws.org/w/a/technical>.

I5. Telephone Inquiries

Telephone inquiries to AWS Headquarters concerning the adoption or extended coverage of existing materials should be limited to questions of a general nature or directly related to the submission all of the information required for the official inquiry. The Board of Directors' policy requires that all AWS staff members respond to a telephone request for an official interpretation of any AWS standard with the information that such an interpretation can be obtained only through a written request. The headquarters staff cannot provide consulting services. The staff can, however, refer a caller to any of these consultants whose names are on file at AWS Headquarters.

I6. The AWS Technical Committee

The activities of AWS technical committees in regard to interpretations are limited strictly to the interpretation of provisions of standards prepared by committee or to consideration of revision to existing provisions on the basis of new data or technology. Neither the committee nor the staff is in a position to offer interpretive or consulting services on (1) specific engineering problems, or (2) requirements of standards applied to fabrications outside the scope of the document or points not specifically covered by the standard. In such cases, the inquirer should seek assistance from a competent engineer experienced in the particular field of interest.

List of AWS Documents on Procedure and Performance Qualification

Designation	Title
B2.1/B2.1M	<i>Specification for Welding Procedure and Performance Qualification</i>
B2.1/B2.1M-BMG	<i>Base Metal Grouping for Welding Procedure and Performance Qualification</i>
B2.1-1-001	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 3/16 through 3/4 inch in the As-Welded Condition, With Backing</i>
B2.1-1-002	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 3/16 through 7/8 inch in the As-Welded Condition, With or Without Backing</i>
B2.1-1-003	<i>Standard Welding Procedure Specification (SWPS) for Gas Metal Arc Welding (Short Circuiting Transfer Mode) of Galvanized Steel (M-1), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-1-004	<i>Standard Welding Procedure Specification (SWPS) for Gas Metal Arc Welding (Short Circuiting Transfer Mode) of Carbon Steel (M-1, Group 1), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-8-005	<i>Standard Welding Procedure Specification (SWPS) for Gas Metal Arc Welding (Short Circuiting Transfer Mode) of Austenitic Stainless Steel (M-8, P-8, or S-8), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-1/8-006	<i>Standard Welding Procedure Specification (SWPS) for Gas Metal Arc Welding (Short Circuiting Transfer Mode) of Carbon Steel to Austenitic Stainless Steel (M-1 to M-8, P-8, or S-8), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-1-007	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Galvanized Steel (M-1), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-1-008	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Carbon Steel (M-1, P-1, or S-1), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-8-009	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8, P-8, or S-8), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-1/8-010	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Carbon Steel to Austenitic Stainless Steel (M-1, P-1, or S-1 to M-8, P-8, or S-8), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-1-011	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Galvanized Steel (M-1), 10 through 18 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-1-012	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1, P-1, or S-1 to M-1, P-1, or S-1), 10 through 18 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-8-013	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 10 through 18 Gauge, in the As-Welded Condition, with or without Backing</i>

Designation	Title
B2.1-1/8-014	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel to Austenitic Stainless Steel (M-1 to M-8/P-8/S-8, Group 1), 10 through 18 Gauge, in the As-Welded Condition, with or without Backing</i>
B2.1-22-015	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Aluminum (M/P-22 to M/P-22), 18 through 10 Gauge, ER4043 or R4043, in the As-Welded Condition, with or without Backing</i>
B2.1-1-016	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E7018, As-Welded or PWHT Condition</i>
B2.1-1-017	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E6010, As-Welded or PWHT Condition</i>
B2.1-1-018	<i>Standard Welding Procedure Specification (SWPS) for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E71T-8, As-Welded Condition</i>
B2.1-1-019	<i>Standard Welding Procedure Specification (SWPS) for CO₂ Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E70T-1 and E71T-1, As-Welded Condition</i>
B2.1-1-020	<i>Standard Welding Procedure Specification (SWPS) for 75% Ar/25% CO₂ Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E70T-1 and E71T-1, As-Welded or PWHT Condition</i>
B2.1-1-021	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, ER70S-2 and E7018, As-Welded or PWHT Condition</i>
B2.1-1-022	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E6010 (Vertical Uphill) Followed by E7018, As-Welded or PWHT Condition</i>
B2.1-8-023	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 through 1-1/2 inch Thick, As-Welded Condition</i>
B2.1-8-024	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 through 1-1/2 inch Thick, ER3XX, As-Welded Condition, Primarily Plate and Structural Applications</i>
B2.1-8-025	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 through 1-1/2 inch Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Plate and Structural Applications</i>
B2.1-1-026	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E6010 (Vertical Downhill) Followed by E7018, As-Welded or PWHT Condition</i>
B2.1-1-027	<i>Standard Welding Procedure Specification (SWPS) for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1 or P-1, Groups 1 and 2), 1/8 through 1/2 inch Thick, E71T-11, As-Welded Condition, Primarily Plate and Structural Applications</i>

Designation	Title
B2.1-1-201	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 3/4 inch Thick, E6010 (Vertical Uphill) Followed by E7018 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications</i>
B2.1-1-202	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 3/4 inch Thick, E6010 (Vertical Downhill) Followed by E7018 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications</i>
B2.1-1-203	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 3/4 inch Thick, E6010 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications</i>
B2.1-1-204	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 3/4 inch Thick, E6010 (Vertical Downhill Root with the Balance Vertical Uphill), As-Welded Condition, Primarily Pipe Applications</i>
B2.1-1-205	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E6010 (Vertical Uphill) Followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications</i>
B2.1-1-206	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E6010 (Vertical Downhill) Followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications</i>
B2.1-1-207	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
B2.1-1-208	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
B2.1-1-209	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
B2.1-1-210	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, INMs-1 and ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
B2.1-1-211	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, INMs-1, ER70S-2, and E7018, As-Welded Condition, Primarily Pipe Applications</i>
B2.1-8-212	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 through 1-1/2 inch Thick, ER3XX, As-Welded Condition, Primarily Pipe Applications</i>
B2.1-8-213	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 through 1-1/2 inch Thick, E3XX-XX, As-Welded Condition, Primarily Pipe Applications</i>

Designation	Title
B2.1-8-214	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 through 1-1/2 inch Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Pipe Applications</i>
B2.1-8-215	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding with Consumable Insert Root of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 through 1-1/2 inch Thick, IN3XX and ER3XX, As-Welded Condition, Primarily Pipe Applications</i>
B2.1-8-216	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 through 1-1/2 inch Thick, IN3XX, ER3XX, and E3XX-XX, As-Welded Condition, Primarily Pipe Applications</i>
B2.1-4-217	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), ER80S-B2, 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 3/4 in. Thick, PWHT Condition, Primarily Pipe Applications</i>
B2.1-4-218	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), E8018-B2, 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, Primarily Pipe Applications</i>
B2.1-4-219	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, ER80S-B2 and E8018-B2, Primarily Pipe Applications</i>
B2.1-4-220	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), E8018-B2, 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 3/4 in. Thick, PWHT Condition, IN515 and ER80S-B2, Primarily Pipe Applications</i>
B2.1-4-221	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, IN515, ER80S-B2, and E8018-B2, Primarily Pipe Applications</i>
B2.1-5A-222	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), ER90S-B3, 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 3/4 in. Thick, PWHT Condition, Primarily Pipe Applications</i>
B2.1-5A-223	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), E9018-B3, 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, Primarily Pipe Applications</i>
B2.1-5A-224	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, ER90S-B3 and E9018-B3, Primarily Pipe Applications</i>
B2.1-5A-225	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 3/4 in. Thick, PWHT Condition, IN521 and ER90S-B3, Primarily Pipe Applications</i>

Designation	Title
B2.1-5A-226	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 through 1/2 in. Thick, As-Welded Condition; 1/8 through 1-1/2 in. Thick, PWHT Condition, IN521, ER90S-B3, and E9018-B3, Primarily Pipe Applications</i>
B2.1-1/8-227	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8, Group 1), 1/16 through 1-1/2 inch Thick, ER309(L), As-Welded Condition, Primarily Pipe Applications</i>
B2.1-1/8-228	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 through 1-1/2 inch Thick, E309(L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications</i>
B2.1-1/8-229	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8, Group 1), 1/8 through 1-1/2 inch Thick, ER309(L) and E309(L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications</i>
B2.1-1/8-230	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8, Group 1), 1/16 through 1-1/2 inch Thick, IN309 and ER309(L), As-Welded Condition, Primarily Pipe Applications</i>
B2.1-1/8-231	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 through 1-1/2 inch Thick, IN309, ER309, and E309-15, -16, or -17, or IN309, ER309(L), and ER309(L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications</i>
B2.1-1-232	<i>Standard Welding Procedure Specification (SWPS) for Argon plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 through 1-1/2 inch Thick, ER70S-3 and E7XT-X, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
B2.1-1-233	<i>Standard Welding Procedure Specification (SWPS) for Argon plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 through 1-1/2 inch Thick, ER70S-3, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
B2.1-1-234	<i>Standard Welding Procedure Specification (SWPS) for Argon plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 through 1-1/2 inch Thick, E7XT-X, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
B2.1-1-235	<i>Standard Welding Procedure Specification (SWPS) for Argon plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 through 1-1/2 inch Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
B2.2	<i>Specification for Brazing Procedure and Performance Qualification</i>
B2.3	<i>Specification for Soldering Procedure and Performance Qualification</i>
B2.4	<i>Specification for Welding Procedure and Performance Qualification for Thermoplastics</i>

This page is intentionally blank.

