Base Metal Grouping for Welding Procedure and Performance Qualification

American Welding Society

second printing, March 2012
Abstract

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. This standard may also be corrected through publication of amendments or errata. It may also be supplemented by publication of addenda. Information on the latest editions of AWS standards including amendments, errata, and addenda are posted on the AWS web page (www.aws.org). Users should ensure that they have the latest edition, amendments, errata, and addenda.

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.

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. 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.
Personnel (Addenda)

AWS B2 Committee on Procedure and Performance Qualification

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

Advisors to the AWS B2 Committee on Procedure and Performance Qualification

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

AWS B2B Subcommittee on Welding Qualifications

M. R. Stone, Chair  Canadian Welding Bureau
A. L. Diaz, Secretary  American Welding Society
D. M. Allbritten  GE Capital
E. W. Beckman  Consultant
K. L. Bingham  Los Alamos National Laboratory
L. P. Connor  Consultant
J. L. Cooley  J. C. & Associates, Incorporated
D. W. Craig  Computer Engineering, Incorporated
AWS B2B Subcommittee on Welding Qualifications (Continued)

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

Advisors to the AWS B2B Subcommittee on Welding Qualifications

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

AWS B2C Subcommittee on Materials

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

Advisors to the AWS B2C Subcommittee on Materials

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

AWS B2 Committee on Procedure and Performance Qualification

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

Advisors to the AWS B2 Committee on Procedure and Performance Qualification

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

AWS B2A Subcommittee on Brazing Qualification

J. L. Cooley, Chair  
J. C. and Associates, Incorporated
S. Morales, Secretary  
American Welding Society
J. J. Fluckiger  
Idaho National Laboratory
L. Guimaraes  
National Automotive Corporation
R. A. LaFave  
Elliott Company
R. L. Peaslee  
Wall Colmonoy Corporation
W. J. Sperko  
Sperko Engineering Services
K. P. Thornberry  
Care Medical, Incorporated
G. M. Wisbrock, Jr.  
Lockheed Martin Missiles and Fire Control (Retired)
R. K. Wiswesser  
Welder Training and Testing Institute
Advisors to the AWS B2A Subcommittee on Brazing Qualification

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

AWS B2B Subcommittee on Welding Qualification

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

Advisors to the AWS B2B Subcommittee on Welding Qualification

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

AWS B2C Subcommittee on Materials

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

Advisors to the AWS B2C Subcommittee on Materials

C. E. Cross  Federal Institute for Material
A. Donlevy  International Titanium Association
G. L. Hoback  Haynes International
B. Moore  Spectrulite
P. Pollak  Aluminum Association
A. P. Seidler  Armco Steel
A. W. Sindel  Sindel and Associates
C. E. Speader, Jr.  Aristech Chemical Corporation
L. T. Vernam  AlcoTec Wire Corporation
G. M. Wisbrock, Jr.  Lockheed Martin Missiles and Fire Control (Retired)
AWS B2D Subcommittee on Standard Welding Procedure Specifications

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

Advisor to the AWS B2D Subcommittee on Standard Welding Procedure Specifications

G. M. Wisbrock, Jr.  Lockheed Martin Missiles and Fire Control (Retired)

AWS B2E Subcommittee on Soldering Qualification

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

Advisors to the AWS B2E Subcommittee on Soldering Qualification

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

AWS B2F Subcommittee on Plastic Welding Qualification

L. T. Hutton, Chair  ARKEMA, Incorporated
R. Hanselka, Vice Chair  Advanced Industrial Design
S. P. Hedrick, Secretary  American Welding Society
K. Argasinki  Solvay Solexis
R. Basile  AB Plastics, Incorporated
M. Callahan  Local 290
D. Chandler  Engiplast, Incorporated
J. Craig  McElroy Manufacturing, Incorporated
P. Demchko  Solvay Solexis
J. J. Fluckiger  Idaho National Laboratory
S. M. Gardiner  IPS Corporation
D. P. Glavin  Steamfitters Local Union 449
G. Hopkins  Plastek Werks, Incorporated
J. Leary  Asahi American, Incorporated
B. B. MacDonald  Consultant
P. F. Martin  United Association
C. L. Parker  Lubrizol Advanced Materials, Incorporated
G. Sample  George Fischer
J. Sciadini  Tech South, Incorporated
K. C. Thomas  Quadrant EPP
M. J. Troughton  TWI
D. Ziegler  Wegener North America, Incorporated
P. Zitkus  Wegener Welding
Advisors to the AWS B2F Subcommittee on Plastic Welding Qualification

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. Hessel</td>
<td>Hessel Ingenieurtechnik GmbH</td>
</tr>
<tr>
<td>R. James</td>
<td>International Training Institute</td>
</tr>
<tr>
<td>A. Lopez</td>
<td>Dow Chemical</td>
</tr>
<tr>
<td>G. M. Wisbrock, Jr.</td>
<td>Lockheed Martin Missiles and Fire Control (Retired)</td>
</tr>
</tbody>
</table>
Table of Contents

Personnel (Addenda) .................................................................................................................................................... v
Personnel (Original) ................................................................................................................................................... vii
List of Tables .......................................................................................................................................................... xi

1. Scope ...................................................................................................................................................................... 1

Annex D—Base Metal Grouping .......................................................................................................................... 3

List of Tables

Table                                      Page No.
---                                      -------
D.1 Listing of Base Metal Specifications—Ferrous Alloys ................................................................. 4
D.1 Listing of Base Metal Specifications—Nonferrous Alloys .............................................................. 44
D.2 M-Number Listing of Base Metals—Ferrous Alloys ........................................................................... 68
D.2 M-Number Listing of Base Metals—Nonferrous Alloys ..................................................................... 135
D.3 Listing of Base Metal Specifications—Iron Castings ........................................................................ 193
Base Metal Grouping for Welding Procedure and Performance Qualification

1. Scope


This publication may be referred to by other codes and standards that have welding procedure and performance requirements in order to avoid duplication of materials tables in those publications.

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 factors involved. For some materials, additional tests may be required. Materials not listed require separate qualification.

Addenda

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

Page 3—D1. Base Metal Specifications—Remove “AISI”

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

Pages 4–67—Table D.1, List of Base Metal Specifications—New base metals have been added and corrections have been made to Table D.1

Pages 68–192—Table D.2, M-Number Listing of Base Metals—New base metals have been added and corrections have been made to Table D.2
Annex D (Normative)

Base Metal Grouping

This annex is part of AWS B2.1/B2.1M-BMG-ADD1:2009, *Base Metal Grouping 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.