

Specification for Fluxes for Brazing and Braze Welding



American Welding Society®



Documents

Document Sharing Hub

AWS A5.31M/A5.31:2012
An American National Standard

Approved by the
American National Standards Institute
February 17, 2012

Specification for Fluxes for Brazing and Braze Welding

2nd Edition

Supersedes ANSI/AWS A5.31-92(R2003)

Prepared by the
American Welding Society (AWS) A5 Committee on Filler Metals and Allied Materials

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

Eighteen fluxes for brazing and braze welding are classified according to the filler metal, form, and activity temperature range. Classification is in accordance with a classification system that employs the designator “FB” to indicate fluxes for brazing and braze welding applications. In addition to selected tests for each classification, major topics include general requirements, testing procedures, and packaging requirements. An annex listing general application guidelines is included.

This specification makes use of both the International System of Units (SI) and U.S. Customary Units. The measurements may not be exact equivalents; therefore, each system shall be used independently.



American Welding Society®

550 N.W. LeJeune Road, Miami, FL 33126



Documents

Document Sharing Hub

International Standard Book Number: 978-0-87171-807-5
American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126
© 2012 by American Welding Society
All rights reserved
Printed in the United States of America

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. 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 (see Annex C). 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 A5 Committee on Filler Metals and Allied Materials. 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 A5 Committee on Filler Metals and Allied Materials 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 A5 Committee on Filler Metals and Allied Materials 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

AWS A5 Committee on Filler Metals and Allied Materials

H. D. Wehr, Chair	<i>Arcos Industries LLC</i>
J. J. DeLoach, Jr., 1 st Vice Chair	<i>Naval Surface Warfare Center</i>
R. D. Fuchs, 2 nd Vice Chair	<i>Bohler Welding Group USA, Incorporated</i>
R. Gupta, Secretary	<i>American Welding Society</i>
T. Anderson	<i>ITW Welding North America</i>
J. M. Blackburn	<i>Naval Sea Systems Command</i>
J. C. Bundy	<i>Hobart Brothers Company</i>
J. L. Caron	<i>Haynes International, Incorporated</i>
D. D. Crockett	<i>Consultant</i>
R. V. Decker	<i>Weldstar</i>
D. A. Del Signore	<i>Consultant</i>
J. DeVito	<i>Consultant</i>
H. W. Ebert	<i>Consultant</i>
D. M. Fedor	<i>The Lincoln Electric Company</i>
J. G. Feldstein	<i>Foster Wheeler North America</i>
S. E. Ferree	<i>ESAB Welding and Cutting Products</i>
D. A. Fink	<i>The Lincoln Electric Company</i>
G. L. Franke	<i>Naval Surface Warfare Center</i>
R. M. Henson	<i>Harris Products Group</i>
S. D. Kiser	<i>Special Metals</i>
P. J. Konkol	<i>Concurrent Technologies Corporation</i>
D. J. Kotecki	<i>Damian Kotecki Welding Consultants</i>
L. G. Kvidahl	<i>Ingalls Shipbuilding</i>
A. Y. Lau	<i>Canadian Welding Bureau</i>
J. S. Lee	<i>Chevron</i>
T. Melfi	<i>The Lincoln Electric Company</i>
K. M. Merlo	<i>Edison Welding Institute</i>
M. T. Merlo	<i>RevWires LLC</i>
B. Mosier	<i>Polymet Corporation</i>
A. K. Mukherjee	<i>Siemens Energy, Incorporated</i>
T. C. Myers	<i>Oceaneering Intervention Engineering</i>
C. L. Null	<i>Consultant</i>
B. A. Pletcher	<i>CB & I, Incorporated</i>
K. C. Pruden	<i>Hydril Company</i>
K. Roossinck	<i>Northrop Grumman Ship Systems</i>
P. K. Salvesen	<i>Det Norske Veritas (DNV)</i>
K. Sampath	<i>Consultant</i>
W. S. Severance	<i>ESAB Welding and Cutting Products</i>
M. F. Sinfield	<i>Naval Surface Warfare Center</i>
M. J. Sullivan	<i>NASSCO-National Steel and Shipbuilding</i>
R. C. Sutherlin	<i>ATI Wah Chang</i>
R. A. Swain	<i>EuroWeld, Limited</i>
M. D. Tumuluru	<i>US Steel Corporation</i>
J. Zhang	<i>Indalco Alloys Inc. of Lincoln Electric</i>

Advisors to the AWS A5 Committee Filler Metals and Allied Materials

R. L. Bateman	<i>Soldaduras West Arco Ltda.</i>
J. E. Beckham	<i>Chrysler, LLC</i>
M. L. Caruso	<i>Special Metals Welding Products Company</i>
R. A. Daemen	<i>Consultant</i>
B. S. Dauble	<i>Carpenter Technology Corporation</i>
T. A. Davenport	<i>PRL Industries</i>
C. E. Fuerstenau	<i>Lucas-Milhaupt, Incorporated</i>
J. P. Hunt	<i>Special Metals</i>
S. Imaoka	<i>KOBE Steel Limited</i>
W. A. Marttila	<i>WAMcom Consulting LLC</i>
R. Menon	<i>Stoody Company</i>
D. R. Miller	<i>ABS</i>
M. P. Parekh	<i>Consultant</i>
J. W. Price	<i>DMI Industries</i>
M. A. Quintana	<i>The Lincoln Electric Company</i>
E. S. Surian	<i>National University of Lomas de Zamora</i>
H. J. White	<i>Consultant</i>

AWS A5H Subcommittee on Filler Metals and Fluxes for Brazing

R. M. Henson, Chair	<i>Harris Products Group</i>
G. L. Alexy, Vice Chair	<i>The Prince & Izant Company</i>
S. N. Borrero, Secretary	<i>American Welding Society</i>
E. R. Boes	<i>Delta Faucet Company</i>
D. Budinger	<i>General Electric Aviation</i>
C. F. Darling	<i>Lucas-Milhaupt, Incorporated</i>
W. J. Engeron	<i>Engeron Technology Group</i>
T. P. Hirthe	<i>Kru-Mar Manufacturing Services, Incorporated</i>
M. J. Lucas Jr.	<i>Belcan Corporation</i>
J. C. Madeni	<i>Colorado School of Mines</i>
R. P. McKinney	<i>The Prince & Izant Company</i>
W. Miglietti	<i>Power Systems Manufacturing, LLC</i>
C. R. Moyer	<i>Bodycote Thermal Processing</i>
T. Oyama	<i>WESGO Metals</i>
J. P. Sands	<i>Wolverine Joining Technologies</i>
M. E. Scruggs	<i>Harris Products Group</i>
A. E. Shapiro	<i>Titanium Brazing, Incorporated</i>
C. M. Volpe	<i>Senior Aerospace-Metal Bellows Division</i>
L. Wolfgram	<i>Lucas-Milhaupt, Incorporated</i>

Advisors to the AWS A5H Subcommittee on Filler Metals and Fluxes for Brazing

R. Aluru	<i>Chromalloy Gas Turbine Corporation</i>
P. A. Baskin	<i>The Superior Flux & Manufacturing Company</i>
Y. Baskin	<i>The Superior Flux & Manufacturing Company</i>
C. E. Fuerstenau	<i>Lucas-Milhaupt, Incorporated</i>
M. J. Kuta	<i>Lucas-Milhaupt, Incorporated</i>

Foreword

This foreword is not part of [AWS A5.31M/A5.31:2012](#), *Specification for Fluxes for Brazing and Braze Welding*, but is included for informational purposes only.

This document is the first of the A5.31 specifications that makes use of both the International System of Units (SI) and U.S. Customary Units. The measurements are not exact equivalents; therefore each system must be used independently of the other, without combining values in any way. In selecting rational metric units, [AWS A1.1](#), *Metric Practice Guide for the Welding Industry*, and International Standard ISO 544, *Welding Consumables—Technical Delivery Conditions for Welding Filler Materials—Type of Product, Dimensions, Tolerances, and Markings*, are used where suitable. Tables and figures make use of both SI Units and U.S. Customary Units, which with the application of the specified tolerances provides for interchangeability of products in both the SI Units and U.S. Customary Units.

This is the second revision of the original specification issued in 1992. The first edition of the *Brazing Manual*, published in 1955, included a numerical list of fluxes. The next two editions, published in 10-year intervals, made numerous changes to the initial listings, but lacked the inclusion of the testing and restrictions normally incorporated in a specification. The *Brazing Manual* was revised again in 1991 and published as the *AWS Brazing Handbook*. The fifth edition of the *Brazing Handbook* was published in 2007.

In 1978, the American Welding Society's Brazing and Soldering Committee recognized the need for a flux specification. About two years later, collaboration between the Committee on Filler Metals and Allied Materials and the Subcommittee on Filler Metals and Fluxes for Brazing led to the initial preparation of the specification. At that point, the magnitude of the challenge to prepare a specification in an industry built on a foundation of proprietary products became apparent. After over a decade of activity by a dedicated group of brazing specialists, the first National Specification, AWS/ANSI A5.31–92, was issued. [AWS A5.31M/A5.31:2012](#) represents over two decades of activity by a dedicated group of brazing specialists.

The present edition, which supersedes ANSI/AWS A5.31–92 (R2003), includes the following updates:

The International System of Units (SI) is used as the primary unit of measurement

Three classes of dispensable fluxes: FB3-L, FB3-M, FB3-N

Sodium Glare Test was removed

Test base metal options added for select flux classifications

Revised shelf life requirements

Revised test specimen and preparation requirements

Test lot definition

Revised retest requirements

Revised particle size test requirements

Adherence Test title now reads as Adhesion Test

Revised fluidity test requirements

A flux viscosity test reference is included

Supplemental Annexes—Informative references and safety considerations

New substantive revisions are noted within the specification in italic font.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS A5 Committee on Filler Metals and Allied Materials, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

This page is intentionally blank.

Table of Contents

	Page No.
<i>Personnel</i>	v
<i>Foreword</i>	vii
<i>List of Tables</i>	xi
<i>List of Figures</i>	xi
1. General Requirements	1
2. Normative References	1
3. Classification	2
4. Acceptance	2
5. Certification	3
6. Rounding-Off Procedure	3
7. Summary of Tests	3
8. Retests	4
9. Test Specimen	4
10. Flux Sample	6
11. Filler Metal	6
12. Water Content Test	6
13. Particle Test	7
14. Adhesion Test	7
15. Fluidity Test	8
16. Fluxing Action Test	8
17. Flow Test	9
18. Life Test	9
19. Viscosity Test	9
20. Method of Manufacture	10
21. Forms	10
22. Packaging	10
23. Marking of Packages	10

Annex A (Informative)—Informative References	11
Annex B (Informative)—Guide to AWS A5.31M/A5.31:2012 , <i>Specification for Fluxes for Brazing and Braze Welding</i>	13
Annex C (Informative)—Guidelines for the Preparation of Technical Inquiries	19
AWS Filler Metal Specifications by Material and Welding Process	21
AWS Filler Metal Specifications and Related Documents	22
List of AWS Documents on Brazing and Soldering	23

List of Tables

Table	Page No.
1 Classification of Brazing Fluxes with Brazing or Braze Welding Filler Metals	3
2 Required Tests	4
3 Filler Metal and Base Metal for Tests, Flow and Life Test Temperature, and Flow Test Minimum Area	5

List of Figures

Figure	Page No.
1 Test Specimen Approximately 1.6 mm [0.062 in] Thick	6
B.1 Precautionary Information for Brazing and Welding Fluxes Containing Fluorides	18