

**AWS B2.3/B2.3M:2018**  
**An American National Standard**

# **Specification for Soldering Procedure and Performance Qualification**



**AWS B2.3/B2.3M:2018  
An American National Standard**

**Approved by the  
American National Standards Institute  
March 29, 2018**

# **Specification for Soldering Procedure and Performance Qualification**

**3rd Edition**

**Supersedes AWS B2.3/B2.3M:2012**

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 soldering procedure specifications, solderers, and soldering operators for manual, mechanized, and automatic soldering. The soldering processes included are torch soldering, furnace soldering, induction soldering, resistance soldering, dip soldering, iron soldering, and infrared soldering. Base metals, soldering filler metals, soldering fluxes, soldering atmospheres, and soldering joint clearances are also included.



ISBN: 978-0-87171-950-8  
© 2018 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](http://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 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 new editions. This standard may also be corrected through publication of amendments or errata, or supplemented by publication of addenda. Information on the latest editions of AWS standards including amendments, errata, and addenda is posted on the AWS web page ([www.aws.org](http://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.

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

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, Standards Development, 8669 NW 36 St, # 130, Miami, FL 33166 (see Annex E). 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, 8669 NW 36 St, # 130, Miami, FL 33166.

This page is intentionally blank.

## Foreword

This foreword is not part of this standard 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, *Specification 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 B2 Committee has published seventy-four SWPSs, B2.2/B2.2M, *Standard for Brazing Procedure and Performance Qualification*, B2.4/B2.4M, *Specification for Welding Procedure and Performance Qualification for Thermoplastics*, and most recently B2.3/B2.3M, *Specification for Soldering Procedure and Performance Qualification*.

This is the third edition of AWS B2.3/B2.3M, *Specification for Soldering and Performance Qualification*. This standard originated in the B2E Subcommittee on Soldering Qualification. The B2E Subcommittee was formed in 2000 in order to explicitly address the unique requirements of soldering procedure and soldering performance qualification outside the spectrum of B2.1/B2.1M, *Specification for Welding Procedure and Performance Qualification*.

*NOTE: The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to the validity of any such claim(s) or of any patent rights in connection therewith. If a patent holder has filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, then details may be obtained from the standards developer.*

A vertical line in the margin or underlined text in clauses, tables, or figures indicates an editorial or technical change from the 2012 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, 8669 NW 36 St, # 130, Miami, FL 33166.

# Table of Contents

	<b>Page No.</b>
<i>Personnel</i> .....	v
<i>Foreword</i> .....	vii
<i>List of Tables</i> .....	x
<i>List of Figures</i> .....	x
<i>List of Forms</i> .....	x
<b>1. General Requirements</b> .....	<b>1</b>
1.1 Scope .....	1
1.2 Units of Measure .....	2
1.3 Safety .....	2
<b>2. Normative References</b> .....	<b>3</b>
<b>3. Terms and Definitions</b> .....	<b>3</b>
<b>4. Soldering Procedure Qualification</b> .....	<b>4</b>
4.1 General .....	4
4.2 Soldered Test Assemblies and Acceptance Criteria .....	5
4.3 Qualification Variables .....	6
<b>5. Soldering Performance Qualification</b> .....	<b>8</b>
5.1 General .....	8
5.2 Qualification by Visual Examination .....	9
5.3 Qualification by Specimen Testing .....	9
5.4 Qualification Variables for Solderers <u>and Soldering Operators</u> .....	10
Annex A (Normative)—Soldering Tables .....	13
Annex B (Normative)—Base Metal Groups .....	23
Annex C (Normative)—Soldering Figures .....	39
Annex D (Informative)— <u>Procedure and Performance Qualification—Sample Forms</u> .....	51
Annex E (Informative)— <u>Requesting an Official Interpretation on an AWS Standard</u> .....	57
Annex F (Informative)—Informative Reference .....	59
List of AWS Documents on Procedure and Performance Qualification .....	61

## List of Tables

Table	Page No.
A.1 Procedure Qualification Soldered Test Assembly .....	13
A.2 Range of Thickness Qualified .....	14
A.3 Base Metals Qualified.....	14
A.4 Soldering Position Qualified by Position of Test Assembly.....	15
A.5 Solder Compositions—wt % (Range or Maximum) .....	16
A.6 Solder Compositions—Zinc Base Alloys .....	18
A.7 Solder Compositions—Tin Base Alloys.....	19
A.8 Solder Compositions—Cadmium Base Alloys .....	19
A.9 List of Inorganic Acid Fluxes and Metal Systems for Which Each Flux is Most Effective.....	20
A.10 Atmospheres for Soldering .....	22
B.1 Base Metal Groups .....	25

## List of Figures

Figure	Page No.
C.1 Cutting Plan of Soldered Test Assembly for Butt Joints in Plate .....	39
C.2 Cutting Plan of Soldered Test Assembly for Lap Joints, Single and Double Spliced Butt Joints, and Rabbet Joints in Plate .....	40
C.3 Cutting Plan of Soldered Test Assembly for Lap Joints and Single and Double Spliced Butt Joints in Plate .....	41
C.4 Cutting Plan of Soldered Test Assembly for All Joints in Pipe and Tube of Greater Than 3 in [76 mm] Outside Diameter .....	42
C.5 Common Joint Configurations for Workmanship Soldered Test Assemblies .....	43
C.6 Typical Joint Design .....	44
C.7 Flow Positions .....	45
C.8 Test Flow Positions .....	46
C.9 Tension Specimen for Butt Joints .....	47
C.10 Tensions Specimens for Lap Joints, Spliced Butt Joints, and Rabbet Joints .....	48
C.11 Tension Test for Small Diameter Pipe .....	49
C.12 Bend Specimen for Butt Joints .....	50

## List of Forms

Form	Page No.
D-1 Solderer Performance Qualification (SPQ) .....	52
D-2 Soldering Procedure Qualification Record (SPQR) .....	53
D-3 Soldering Procedure Specification (SPS) .....	55

# Specification for Soldering Procedure and Performance Qualification

## 1. General Requirements

**1.1 Scope.** This specification provides the requirements for qualification of soldering procedure specifications. This specification also provides requirements for the performance qualification of solderers and soldering operators and is intended for use where referenced by a product standard or contract document. This specification is not applicable to the soldering of electrical or electronic components, including connections and terminations.

Employers shall be responsible for the soldering done by their organization, including the use of qualified soldering procedures, qualified solderers, and qualified soldering operators. It is the Employer's responsibility to assure that soldering procedure specifications meet any additional requirements of the Referencing Document. Each Employer shall maintain the applicable soldering procedure specifications, soldering procedure qualification records, and soldering performance qualification records.

When not otherwise specified by the Referencing Document, the edition of the 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 document is intended primarily for use with the following soldering processes:

- (1) Torch soldering (TS)
- (2) Furnace soldering (FS)
- (3) Induction soldering (IS)
- (4) Resistance soldering (RS)
- (5) Dip soldering (DS)
- (6) Iron soldering (INS)
- (7) Infrared soldering (IRS)

**1.1.1 Base Metals.** The grouping of base metals by Base Metal Number (BM No.) in Table B.1 has been made on the basis of metallurgical compatibility, chemical composition, and solderability to decrease the number of required soldering qualifications. The grouping does not imply that base metals may be indiscriminately substituted within the same BM No. without consideration of their applicability. For some materials or combinations of materials, additional tests may be required by the procuring activity or the design engineer.

Base metals are identified by their ASTM,<sup>1</sup> ABS,<sup>2</sup> or UNS<sup>3</sup> designations. Cross reference specifications, listed in the Unified Numbering System for Metals and Alloys opposite a given UNS No., are included in the same BM No. group as the given UNS Number.

<sup>1</sup> ASTM—American Society for Testing and Materials.

<sup>2</sup> ABS—American Bureau of Shipping.

<sup>3</sup> UNS—Unified Numbering System.