

AWS D18.1/D18.1M:2020
An American National Standard

**Specification for
Welding of
Austenitic
Stainless Steel
Tube and Pipe
Systems in
Sanitary (Hygienic)
Applications**



**AWS D18.1/D18.1M:2020
An American National Standard**

**Approved by the
American National Standards Institute
March 5, 2020**

**Specification for Welding
of Austenitic Stainless Steel
Tube and Pipe Systems in
Sanitary (Hygienic) Applications**

3rd Edition

Revises AWS D18.1/D18.1M:2009

Prepared by the
American Welding Society (AWS) D18 Committee on Welding in Sanitary Applications

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This specification provides the requirements for welds in tubing systems in dairy and other food processing plants. The document addresses qualifications, fabrication, extent of visual examination, acceptance criteria, and documentation requirements.



ISBN Print: 978-1-64322-125-0
ISBN PDF: 978-1-64322-126-7
© 2020 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 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). 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 A). 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 D18 Committee on Welding in Sanitary Applications. 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 D18 Committee on Welding in Sanitary Applications 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 D18 Committee on Welding in Sanitary Applications 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.

Foreword

This foreword is not part of this standard but is included for informational purposes only.

The formation of the D18 Committee was approved in 1995 by the Technical Activities Committee and the Board of Directors. The Committee was formed to respond to the request of the 3-A Sanitary Standards Committee (now the 3-A Sanitary Standards, Inc., or 3-A SSI)¹ for help in preparing welding standards for use in the manufacture and construction of dairy and food product processing plants. The 3-A SSI develops sanitary design standards for dairy and food processing, packaging, and handling equipment and systems. Several members of the Committee are active members of 3-A SSI, and the D18 Committee has maintained liaison with 3-A SSI.

This document supersedes AWS D18.1/D18.1M:2009, *Specification for Welding of Austenitic Stainless Steel Tube and Pipe Systems in Sanitary (Hygienic) Applications*. Principal changes in the third edition involve enhancements to the sections on welding procedure qualifications and qualification records.

A vertical line in the margin or underlined text in clauses, tables, or figures indicates an editorial or technical change from the 2009 edition. The following is a summary of the most relevant revisions to the D18.1/D18.1M specification:

- The scope was clarified to point out that applicable portions could be used as needed.
- Several definitions, figures, and text were changed to more closely align with AWS A3.0M/A3.0, *Standard Welding Terms and Definitions*, and AWS D1.6/D1.6M, *Structural Welding Code—Stainless Steel*.
- Welding procedure qualification requirements and sample forms were changed to be more consistent with AWS B2.1/B2.1M, *Specification for Welding Procedure and Performance Qualification*, where possible.
- Qualification and verification variables for procedure qualifications in Table 1 were modified to eliminate overlap with AWS B2.1/B2.1M.
- The qualification and welding variables for performance qualification in the second edition were eliminated and performance qualification is now totally in accordance with AWS B2.1/B2.1M.
- Several SI conversions were harmonized to current AWS guidelines.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary,

AWS D18 Committee on Welding in Sanitary Applications, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

¹3-A standards are published by 3-A Sanitary Standards, Inc., 6888 Elm Street, Suite 2D, McLean, VA 22101.

Table of Contents

	Page No.
<i>Dedication</i>	v
<i>Personnel</i>	vii
<i>Foreword</i>	ix
<i>List of Tables</i>	xii
<i>List of Figures</i>	xii
1. General Requirements	1
1.1 Scope	1
1.2 Units of Measure	1
1.3 Safety	1
1.4 Owner's Responsibility	2
1.5 Welding Symbols	2
2. Normative References	2
3. Terms and Definitions	2
4. Qualification	4
4.1 Procedure Qualification	4
4.2 Performance Qualification	6
5. Fabrication Practices	7
5.1 Mandatory Standard Practices	7
5.2 Nonmandatory Standard Practices	7
5.3 Fabrication	7
5.4 Preconstruction Weld Samples	7
6. Visual Examination Requirements	8
6.1 Responsibilities for and Extent of Examination	8
6.2 Examination Techniques	8
6.3 Examination Requirements and Acceptance Criteria	8
7. Documentation	13
Annex A (Informative)— <u>Requesting an Official Interpretation on an AWS Standard</u>	15
Annex B (Informative)— <u>Sample Documentation Forms</u>	17
<u>Annex C (Informative)—Informative References</u>	31
List of AWS Documents on Welding in Sanitary Applications	33

List of Tables

Table		Page No.
<u>1</u>	<u>Qualification and Verification Variables for Procedure Qualification</u>	5
<u>2</u>	<u>Visual Examination Acceptance Criteria for the Outside Surfaces of Welds</u>	10
<u>3</u>	<u>Visual Examination Acceptance Criteria for the Inside Surfaces of Welds</u>	11

List of Figures

Figure		Page No.
<u>1</u>	<u>Examination Requirements Process Flowchart (Autogenous and Filler Metal)</u>	9
<u>2</u>	<u>Examples of Weld Discontinuity Limits</u>	12
<u>3</u>	<u>Weld Discoloration Levels on Inside of Austenitic Stainless Steel Tube</u>	13

Specification for Welding of Austenitic Stainless Steel Tube and Pipe Systems in Sanitary (Hygienic) Applications

1. General Requirements

1.1 Scope. This specification covers the requirements for gas tungsten arc welding (GTAW) and plasma arc welding (PAW) of stainless steel tube and pipe 1/4 in [6 mm] diameter and larger in the fabrication and construction of new sanitary (hygienic) processing systems. This specification includes the welding of tube and pipe for the transportation of sanitary (hygienic) system products and cleaning or sanitizing solutions. It includes manual welding as well as mechanized or automatic welding, such as orbital welding. This specification addresses welding procedure and performance qualification as well as visual examination requirements for as-welded surfaces and finished surfaces.

This specification is intended for new construction. However, the requirements may also be applied to maintenance and repair of food processing equipment. When there is a conflict between this specification and a design specification to which the equipment is being constructed, the applicable code shall govern on issues that apply to structural design or structural integrity. This specification does not address requirements designed to prevent corrosion damage during service or any structural design or integrity aspects of components or systems used for sanitary (hygienic) applications.

Sanitary processing systems are intended to include those systems handling products for human and animal consumption, or for cleaning and sanitizing solutions used in these systems. Such products include dairy, meat, poultry, vegetables, beverages, personal care items (such as shampoo, soap, toothpaste, cosmetics), and other products consumed or used by humans or animals, which require freedom from contamination.

When this specification is stipulated in contract documents, conformance with all provisions of this specification is required except provisions specifically modified or exempted by the Owner, their representative, or the contract documents.

1.2 Units of Measure. 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.

1.3 Safety. Safety and health issues and concerns are beyond the scope of this standard; some safety and health information is provided, but such issues are not fully addressed herein.

Safety and health information is available from the following sources:

American Welding Society:

- (1) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*
- (2) AWS Safety and Health Fact Sheets
- (3) Other safety and health information on the AWS website

Material or Equipment Manufacturers:

- (1) Safety Data Sheets supplied by materials manufacturers
- (2) Operating Manuals supplied by equipment manufacturers

Applicable Regulatory Agencies

Work performed in accordance with this standard may involve the use of materials that have been deemed hazardous, and may involve operations or equipment that may cause injury or death. This standard does not purport to address all