


**AWS D17.2/D17.2M:2019**  
**An American National Standard**



# **Specification for Resistance Welding for Aerospace Applications**



**AWS D17.2/D17.2M:2019**  
**An American National Standard**

**Approved by the**  
**American National Standards Institute**  
**February 27, 2018**

**Specification for**  
**Resistance Welding for**  
**Aerospace Applications**

**3rd Edition**

**Supersedes AWS D17.2/D17.2M:2013**

Prepared by the  
American Welding Society (AWS) D17 Committee on Welding in the Aircraft and Aerospace Industry

Under the Direction of the  
AWS Technical Activities Committee

Approved by the  
AWS Board of Directors

**Abstract**

This specification provides the general resistance welding requirements for aerospace hardware. It includes, but is not limited to, resistance spot and resistance seam welding of aluminum, magnesium, iron, nickel, cobalt, and titanium-based alloys. There are requirements for machine and welding schedule qualification, production witness samples, and inspection and acceptance criteria for aerospace hardware.



ISBN Print: 978-0-87171-952-2  
ISBN PDF: 978-1-64322-020-8  
© 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 Division, 8669 NW 36<sup>th</sup> Street, Suite 130, Miami, FL 33166 (see Annex F). 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 D17 Committee on Welding in the Aircraft and Aerospace Industry. 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 D17 Committee on Welding in the Aircraft and Aerospace Industry 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 D17 Committee on Welding in the Aircraft and Aerospace Industry 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<sup>th</sup> Street, Suite 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.

In the mid 1990s, the AWS D17 Committee on Welding in the Aircraft and Aerospace Industries decided it was necessary to form a subcommittee to write a resistance spot and seam welding specification.

This is the third edition of the D17.2/D17.2M specification. This specification is intended to replace the following documents:

MIL-W-6858D, *Welding, Resistance: Spot and Seam*, March 28, 1978

AMS-W-6858A, *Welding, Resistance Spot and Seam*, April 1, 2000

MIL-W-6858D or AMS-W-6858A, or both, take precedence over this specification only when they are cited by the contract documents.

A vertical line in the margin and underlined text in clauses, tables, or figures indicates an editorial or technical change from the 2013 edition.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS D17 Committee on Welding in the Aircraft and Aerospace Industries, American Welding Society, 8669 NW 36<sup>th</sup> Street, Suite 130, Miami, FL 33166.

This page is intentionally blank.

## Table of Contents

	Page No.
<i>Personnel</i> .....	v
<i>Foreword</i> .....	vii
<i>List of Tables</i> .....	x
<i>List of Figures</i> .....	x
<b>1. General Requirements</b> .....	1
1.1 Scope .....	1
1.2 Units of Measure .....	1
1.3 Safety .....	1
<b>2. Normative References</b> .....	2
<b>3. Terms and Definitions</b> .....	2
<b>4. Requirements</b> .....	3
4.1 Design Requirements .....	3
4.2 Materials and Methods of Preparation .....	8
4.3 Equipment Requirements .....	9
4.4 Personnel .....	9
4.5 Qualification of Welding Machines .....	9
4.6 Welding <u>Schedule</u> Certification .....	10
4.7 Production Verification Testing .....	17
4.8 Acceptance Criteria .....	17
<b>5. Quality Assurance Provisions</b> .....	25
5.1 Production Quality Control .....	25
5.2 Production Witness Specimens .....	25
5.3 Inspection of Production Parts .....	27
Annex A (Informative)— <u>Form for Resistance Welding Data Sheet for Spot Welding</u> .....	29
Annex B (Informative)— <u>Form for Resistance Welding Data Sheet for Seam and Roll Spot Welding</u> .....	31
Annex C (Informative)— <u>Informative References</u> .....	33
Annex D (Informative)— <u>Recommendation for a Metallographic Method for the Examination of Weld Penetration in Resistance Seam Welds</u> .....	35
Annex E (Informative)— <u>Commentary</u> .....	39
Annex F (Informative)— <u>Requesting an Official Interpretation on an AWS Standard</u> .....	45
List of AWS Documents on Welding in the Aircraft and Aerospace Industries .....	47



## List of Tables

Table		Page No.
1	Shear Load Requirements for Spot Weld Sheet Specimens Group 1 Alloys—Aluminum and Magnesium Alloys . . . . .	4
2	Shear Load Requirements for Spot Weld Sheet Specimens Group 2 Alloys—Steel, Nickel, and Cobalt Alloys. . . . .	5
3	Shear Load Requirements for Spot Weld Sheet Specimens Group 3 Alloys—Titanium Alloys. . . . .	6
4	Shear Load Requirements for Spot Welds in Foil . . . . .	7
5	Machine Qualification Specimens and Examination Requirements . . . . .	11
6	<u>Welding Schedule</u> Certification Specimen and Examination Requirements Spot Welds—Sheet . . . . .	12
7	<u>Welding Schedule</u> Certification Specimen and Examination Requirements Spot Welds—Foil . . . . .	12
8	<u>Welding Schedule</u> Certification Specimen and Examination Requirements Seam Welds—Sheet . . . . .	12
9	<u>Welding Schedule</u> Certification Specimen and Examination Requirements Seam Welds—Foil . . . . .	13
10	Limits for Visible Discontinuities in Production Parts or Lots . . . . .	18
11	Nugget Size (All Groups). . . . .	20
12	Internal Metallographic Imperfections for Production Witness Samples or Sectioned Parts . . . . .	22
13	Production Witness Welds, Test Lots. . . . .	26

## List of Figures

Figure		Page No.
1	Spot Welds in Sheet . . . . .	13
2	Close-Spaced Spot Welds in Sheet. . . . .	14
3	Spot Welds in Foil for Class A Welds . . . . .	14
4	Spot and Seam Welds in Foil, Peel Specimen for Class C Welds . . . . .	15
5	Seam Welds in Sheet . . . . .	15
6	Pressure Test of Seam Welds in Foil, for Class A Welds . . . . .	16
7	Nomenclature for Metallographic Spot Weld Sections and Seam Weld Transverse Sections. . . . .	18
8	Surface Indentation . . . . .	19
9	Nomenclature Diagram of Spot and Seam Weld Radiographs . . . . .	21
10	Minimum Penetration. . . . .	22
11	Shear Tests of Three or More Thicknesses . . . . .	23

# Specification for Resistance Welding for Aerospace Applications

## 1. General Requirements

**1.1 Scope.** This specification covers requirements for resistance spot and seam welding of the following metals and their alloys.

### 1.1.1 Material Groups

Group 1—Aluminum and magnesium

Group 2—Steel, nickel, and cobalt

Group 3—Titanium

**1.1.2 Classification.** Classification is based on the following:

Class A—A welded joint, whose failure during any operating condition would cause loss of the equipment or system or one of its major components.

Class B—A welded joint whose failure would reduce the overall strength of the equipment or system or limit the intended functioning or use of equipment.

Class C—A welded joint for which no stress analysis is required and whose failure would not affect the performance of the equipment or system.

**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 shall be used independently.

**1.3 Safety.** Safety and health issues and concerns are beyond the scope of this standard and therefore are not 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 safety and health risks that may be encountered. The user of this standard should establish an appropriate safety program to address such risks as well as to meet applicable regulatory requirements. ANSI Z49.1 should be considered when developing the safety program.