AWS D8.2M:2026
An American National Standard

Specification for Automotive Weld Quality—Resistance Spot Welding of Aluminum



American Welding Society®



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Specification for Automotive Weld Quality—Resistance Spot Welding of Aluminum

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Prepared by the
American Welding Society (AWS) D8 Committee on Automotive Welding

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This document contains both visual and measurable acceptance criteria for resistance spot welds in aluminum. The information contained herein may be used as an aid by designers, resistance welding equipment manufacturers, welded product producers, and others involved in the automotive industry and resistance spot welding of aluminum.

American Welding Society®

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Dedication

This revision of AWS D8.2M, S*pecification for Automotive Weld Quality—Resistance Spot Welding of Aluminum*, is respectfully dedicated to the memory of Bill Qualls, who served on the AWS D8 Committee on Automotive Welding since 2005 and as the Chairman of the AWS D8D Subcommittee on Automotive Resistance Spot Welding since 2015.

The Committee sadly misses his leadership, wisdom, and friendship. His commitment and significant contributions to the advancement of the automotive industry and resistance welding will live on through this new revision.

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Foreword

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

This document was prepared to establish post-weld acceptance criteria for resistance spot welds in automotive structures fabricated from aluminum. As a specification, the criteria and techniques contained herein are obligatory when cited as a normative reference on a drawing or in a contract.

This specification was prepared by a Task Group of the D8D Subcommittee on Automotive Resistance Spot Welding of the AWS D8 Committee on Automotive Welding.

Editorial and technical revisions from the previous edition are indicated by underlined text. Changes in tables and figures have a single, vertical line in the margin.

Comments and inquiries concerning this standard are welcome. They should be sent to the Secretary, AWS D8 Committee on Automotive Welding, American Welding Society, 8669 NW 36 St, # 130 Miami, FL 33166.

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Specification for Automotive Weld Quality—Resistance Spot Welding of Aluminum

1. General Requirements

1.1 Scope. This specification expresses the quality characteristics and metrics pertinent to individual resistance spot welds on automotive aluminum structures. The acceptance criteria are the same for all welds regardless of the service load and intended to be applied in conditions typically encountered during manufacturing. Welds at variance from the stated weld quality criteria in this document can still have mechanical properties that satisfy product and design requirements as per agreement between customer and supplier. Any attempted application of this document or the evaluation criteria used herein to other uses, for example post-crash weld quality assessment, may lead to an erroneous result.

1.2 Units of Measurement. This standard makes sole use of the International System of Units (SI).

1.3 Safety. Safety issues and concerns are addressed in this standard, although health issues and concerns are beyond the scope of this standard. 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.

2. Normative References

The documents listed below are referenced within this publication and are mandatory to the extent specified herein. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments or revisions of the publications may not apply since the relevant requirements may have changed.

American Welding Society (AWS) documents:

AWS A3.0M/A3.0, *Standard Welding Terms and Definitions Including Terms for Additive Manufacturing, Adhesive Bonding, Brazing, Soldering, Thermal Cutting, Thermal Spraying, and Nondestructive Examination.*

AWS D8.9M, *Test Methods for Evaluating the Resistance Spot Welding Behavior of Automotive Sheet Steel Materials.*

3. Terms and Definitions

AWS A3.0M/A3.0, *Standard Welding Terms and Definitions,* provides the basis for terms and definitions used herein. However, the following terms and definitions are included below to accommodate usage specific to this document.

aspect ratio. The ratio of the maximum diameter to the minimum diameter of the area of fusion at interface.

button. The part of a spot weld which tears out during destructive testing of welded aluminum. It may include all or part of the nugget, the heat-affected zone (HAZ), and the base metal. A hole is left in the mating sheet(s).

coupon. Raw material: a single, small piece of test material with specified dimensions used to produce test samples.

close-spaced spot welds. Spot welds on sheet placed less than two diameters apart (Ds as defined in Table 11), center to center. Such proximity may require more power than other spot welds.

cross tension test. A destructive test to measure spot weld strength and weld size with the test weld in the plane perpendicular (direct tension) to the applied load.

cross tension test sample. A lap joint test sample, composed of two cross tension test coupons having a specified overlap and standard size, used to determine the direct tension strength of the test weld and its fracture mode.

edge weld. A spot weld area, as defined by the impression left by the electrodes, which is not fully contained within all original edges of the sheet metal.

electrode face diameter. The mean diameter of the electrode surface (which contacts the sheet surface) before the electrode is dressed. This dimension is the as-ordered or as-machined diameter measured prior to electrode installation and dressing.

electrode indentation. A depression formed on the surface of the workpiece by an electrode.

expulsion. The ejection of molten metal during welding, either at the faying surface or contact point(s) of the electrode face. See also surface expulsion.

fracture mode. The appearance of the weld after peel testing, such as, button pull, partial thickness fracture, interfacial fracture, or combinations thereof. See Figures 10 through 17.

fused area. The area of the nugget at the faying surface (interface between the metals being joined). The fused area may result in button pull, partial thickness fracture, interfacial fracture, or combinations thereof.

fused region diameter (FD). The diameter of the nugget fused region.

fused zone. A nonstandard term for fusion zone.

fusion zone. The portion of the weld that melted during the welding process. The fusion zone is visible when a weld is cross sectioned and suitably etched.

governing metal thickness (GMT). The metal gauge in a stack-up determines the minimum acceptable weld size. The GMT for a two-sheet stack-up is the metal thickness of the thinner of the two sheets. Generally, the GMT for a three-sheet stack-up is the metal thickness of the thinner sheet at each interface.

heat-affected zone (HAZ). The portion of base metal adjacent to the nugget whose mechanical properties or microstructure have been altered by the heat input from welding.

indentation. Indentation is the ratio of the amount of weld depression to the prewelded sheet thickness, expressed as a percentage of sheet thickness.

interfacial fracture. A fracture mode of a spot weld where all of the weld nugget separates through the plane of the weld at the faying surface. If less than approximately 20% of the mating sheet thickness is removed, the fracture is interfacial (example in Figure 15).

metallographic section. A transverse cut on the diameter of a spot weld or across a seam weld, or a longitudinal cut down the center of a seam weld, polished down to near the center of the weld and etched to accentuate the metallographic structure.

minimum contact overlap. The minimum distance to contain a weld with respect to the edge of the material to be joined.

minimum weld size (MWS). The smallest allowable weld size by specification.

nugget. The weld metal joining the workpieces, consisting of the fusion zone (solidified metal), but excluding the heat-affected zone.

nugget size. A nonstandard term when used for resistance weld size.

partial thickness fracture. A fracture mode of a spot weld where a part of the weld nugget shows removal of parent metal by the weld from the mating sheet. The portion removed must be approximately 20% of the mating sheet thickness, otherwise the fracture is interfacial. A cavity is left in the mating sheet (see example in Figure 11).

peel test. A mechanical test in which a lap joint test sample is pulled apart to determine the fracture mode and weld size. A button is not necessarily equal in size to the cast nugget underlying it.

peel-test sample. A lap-joint test sample composed of two peel-test coupons having a specified overlap and standard size, which is used to determine the weld button size and fracture mode of a resistance spot weld.

shear tension test. A destructive test to measure spot weld strength and button size with the test weld in the same plane (shear orientation) as the applied load.

shear tension test sample. A lap-joint test sample composed of two shear-test coupons having a specified overlap and standard size, which is used to determine the shear strength of the test weld and its fracture mode.

sheet. A material having thickness, for the purpose of this specification, of more than 0.60 mm to 3.60 mm.

stack-up. The number of sheets and materials being joined by the spot weld.

tensile strength. Ultimate tensile strength.

test sample. a single test specimen made from raw material coupons for a specific test.

test weld. A weld made on any sample used to determine weld size, weld strength, button fracture mode, or in combination.

top surface. For sheets with nominally equal coating weight on both sides, the top surface is the surface facing up (toward the viewer) in a stack of sheets. For differentially coated sheets this is the side having the heavier coating weight. NOTE: If the heavier side of differentially coated sheets is not known or coded, preliminary coating weight analyses shall be performed as per 5.3 before proceeding with any marking and shearing operations.

top surface identification (ID) mark. A mark, used to indicate the top surface of an untrimmed sheet, which is sufficiently long to be visible on the trimmed sheet.

surface expulsion. Expulsion occurring between the electrode and the workpiece.

weld button pull. A fracture mode of a spot weld where separation occurs through the heat-affected zone (HAZ) of the weld, resulting in a button (see example in Figure 10).

weld button size. The average of the maximum and minimum diameters of the button.

weld penetration. The ratio of the nugget's maximum depth of fusion to the prewelded base metal thickness, expressed as a percentage.

weld size. The average of the maximum and minimum dimensions of the fused area in destructive inspection or the nugget width in metallographic inspection.

weld discrepancy. A weld condition deviating from the applicable standard, specification, or engineering drawing.

weld fusion zone (WFZ). The portion of the weld area consisting of weld metal. See also heat-affected zone.

resistance weld size. The diameter of a spot weld nugget or the width of a seam weld nugget measured at the plane of the faying surfaces.

4. Weld Process Control

Production-welded parts being joined by the resistance spot welding process have inherent variability of weld characteristics. The welding process must be controlled to meet or exceed the minimum weld quality level of the product requirements. Information and guidance pertaining to supplier requirements for process and product control are contained in IATF 16949:2016 (published by the Automotive Industry Action Group (AIAG)); ISO 9001:2015; or ASTM E2587 Practice for Use of Control Charts in Statistical Process Control.