AWS C1.4M/C1.4:2025
An American National Standard

Specification for Resistance Welding of Carbon and Low-Alloy Steels



American Welding Society®



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Approved by the
American National Standards Institute
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Specification for Resistance Welding of Carbon and Low-Alloy Steels

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Prepared by the
American Welding Society (AWS) C1 Committee on Resistance Welding

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This specification provides the shear strength and weld button diameter requirements for carbon steel and low-alloy steel sheet resistance and projection welds.

American Welding Society®

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This standard is subject to revision at any time by the AWS C1 Committee on Resistance Welding. It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn.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 requested and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS C1 Committee on Resistance Welding 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 C1 Committee on Resistance Welding 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 revision of AWS C1.4M/C1.4, *Specification for Resistance Welding of Carbon and Low-Alloy Steels*, is respectfully dedicated to the memory of Bill Qualls, who served on the AWS C1 Committee on Resistance Welding since 1989 and as Vice Chairman of the AWS C1 Committee since 2008.

The Committee sadly misses his leadership, wisdom, and friendship. His commitment and significant contributions to the advancement of 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.

The original edition of C1.4M/C1.4, *Specification for Resistance Welding of Carbon and Low-Alloy Steels,* replaced the following documents:

MIL-W-12332A, *Welding, Resistance, Spot, Seam, and Projection; for Fabricating Assemblies of Low Carbon Steel*

MIL-W-45223A, *Welding Spot-Hardenable-Steel*

MIL-W-46154, *Welding, Resistance, Spot and Projection for Fabricating Assemblies of Carbon Steel Sheets*

MIL-W-6858 and/or AMS –W-6858 may take precedence over this standard based on contract specification.

All changes to the 2017 edition are identified by a vertical line in the margin next to the text or an underline.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS C1 Committee on Resistance Welding, American Welding Society, 8669 NW 36th St, #130, Miami, FL 33166.

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Specification for Resistance Welding of Carbon and Low-Alloy Steels

1. General Requirements

1.1 Scope. This specification establishes welding equipment requirements and welding procedures used to produce welds of acceptable quality in coated and uncoated carbon and low-alloy steels, including mild steels and high strength low alloy (HSLA) steels. Since this standard relies on a pulled button to validate the welding procedure, it may not apply to the welding of Advanced High Strength Steels (AHSS) including: dual phase (DP), transformation induced plasticity (TRIP), complex phase (CP) and martensitic steels (MART); or to hot stamped steels (HSS).

1.2 Units of Measurement. This standard makes use of both the International System of Units (SI) and U.S. Customary Units. 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 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 A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*

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.*

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.

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

governing material thickness (t). The thickness of the thinnest member of two contacting surfaces is the governing material thickness of a weld joint. Welding requirements are based on this thickness.

high strength low alloy (HSLA) steel. Steels with a low percentage of carbon and a yield strength of at least 340 MPa [49 ksi].

minimum button diameter. The smallest measured resistance weld button size.

nominal button diameter. The desired resistance weld button size

setup button diameter. The resistance weld button size achieved under ideal starting conditions.

tension-shear test. A destructive test designated to measure spot weld strength under load applied in the plane of faying surfaces.

terne. An alloy of lead containing 3–15% tin used as a hot dip coating for steel.

u-tension test. See cross tension test.

4. General

An acceptable weld has a pulled button diameter (or size) greater than the minimums shown in Table 1 for spot welds, Table 2 for projection welds, or Table 3 for seam welds. At the start of a production run, the welding machine, tooling, and setup should be able to produce a pulled button diameter as close as practical to the setup values as shown in the tables, or per established quality plan, which may include statistical methods. For recommended guidelines to obtain the desired setup button diameter or seam width, see AWS C1.1M/C1.1, *Recommended Practices for Resistance Welding.* As production welding continues, the button diameter may decrease in size to the minimum button diameter. When the button diameter falls outside of the established limits, adjustment of the equipment, electrode maintenance, or both shall be required to reestablish the button diameter to above the nominal and approaching the setup diameter, or per the quality plan. For purposes of welded assembly design simulation, the intended strength of the weld shall be based upon the minimum pulled button diameter, as specified in Tables 1, 2, 3, or Tension-Shear Strength from Tables 4 or 5.

4.1 Materials. This specification is applicable to resistance welding of carbon and low-alloy steels with a carbon content of up to 0.60% (by weight). For seam welding, the specification is limited to carbon and low-alloy steels with a carbon content of up to 0.25% (by weight). The aforementioned carbon contents are specified in International Iron and Steel Institute (IISI) specifications. Hardenable steels may require a tempering treatment after welding to provide sufficient ductility.