

AWS C3.9M/C3.9:2020
An American National Standard



Specification for Resistance Brazing



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Approved by
American National Standards Institute
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Specification for **Resistance Brazing**

2nd Edition

Revises AWS C3.9M/C3.9:2009

Prepared by the
American Welding Society (AWS) C3 Committee on Brazing and Soldering

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This specification provides the minimum fabrication, equipment, material, and process procedure requirements, as well as discontinuity limits for the resistance brazing of steels, copper, copper alloys, heat- and corrosion-resistant alloys, and other materials that can be adequately resistance brazed (the resistance brazing of aluminum alloys is addressed in AWS C3.7M/C3.7, *Specification for Aluminum Brazing*). This specification provides criteria for classifying resistance brazed joints based on loading and the consequences of failure and quality assurance criteria defining the limits of acceptability in each class. This specification defines acceptable resistance brazing equipment, materials, and procedures, as well as the required inspection for each class of joint.



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This standard is subject to revision at any time by the AWS C3 Committee on Brazing and Soldering. It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn.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 C3 Committee on Brazing and Soldering 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 C3 Committee on Brazing and Soldering 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.

This specification is one of a series prepared at the request of the Aerospace Materials Division (AMD) of the Society of Automotive Engineers (SAE) and a number of other organizations to replace the military specification MIL-B-7883, *Brazing of Steels, Copper, Copper Alloys, Nickel Alloys, Aluminum, and Aluminum Alloys*, which addressed all brazing processes. It became both obsolete and very cumbersome as brazing technology proliferated and became more complex.

Addressing all of the diverse brazing processes in one concise, easily understood document was found to be impractical; therefore, a series of six independent specifications on brazing have been written, all in the same format. These are AWS C3.4M/C3.4, *Specification for Torch Brazing*; AWS C3.5M/C3.5, *Specification for Induction Brazing*; AWS C3.6M/C3.6, *Specification for Furnace Brazing*; AWS C3.7M/C3.7, *Specification for Aluminum Brazing*; AWS C3.8M/C3.8, *Specification for the Ultrasonic Pulse-Echo Examination of Brazed Joints*; and the present document, AWS C3.9M/C3.9, *Specification for Resistance Brazing*. The decision to subdivide the technology in this way was based on a survey of production brazing applications conducted by the AWS C3 Committee on Brazing and Soldering. The survey demonstrated that these six specifications would cover the vast majority of brazing performed today.

After the completion of the fourth brazing specification, it was determined that a document providing specific criteria and requirements for the application of ultrasonic testing to brazed joints was needed. Therefore, AWS C3.8M/C3.8, *Specification for the Ultrasonic Pulse-Echo Examination of Brazed Joints*, was written to complement this series.

AWS C3.9M/C3.9, *Specification for Resistance Brazing*, has been added to this group of diverse standards on brazing processes because resistance brazing is an additional commercial brazing method used in many industries. The specifics for this method are detailed in the same manner as the other five independent brazing specifications.

This is the second edition of AWS C3.9M/C3.9, *Specification for Resistance Brazing*. The first edition was released in 2009. This second edition has added specific language pertaining to the qualification of Brazing Procedure Specifications (BPSs) and brazing personnel; the inspection of brazed joints; and acceptance criteria. A commentary section has also been added to this edition.

All errata to a standard shall be published in the *Welding Journal* and posted on the AWS website.

Underlined text or a vertical line in the margin indicates a change from the previous edition.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS C3 Committee on Brazing and Soldering, American Welding Society, 8669 NW 36 St., #130, Miami, FL 33166.

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Specification for Resistance Brazing

1. General Requirements

1.1 Scope. This specification presents the minimum fabrication and quality requirements for the resistance brazing of materials such as steels, stainless steels, copper, copper alloys, and heat- or corrosion-resistant materials as well as other materials that can be adequately resistance brazed.

The purpose of this specification is to standardize resistance brazing process requirements and control braze joint quality for all applications requiring brazed joints of assured quality. This document establishes the minimum requirements for processes and products with explanatory information so that sources of ambiguity are minimized. It assigns responsibility for the ultimate quality of the brazed product to a single organization and permits that organization to modify requirements if appropriate to the application. It requires proper documentation of any such modifications.

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 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 the 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) standards:

- AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*