AWS C3.4M/C3.4:2026
An American National Standard

Specification for Torch Brazing



American Welding Society®



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An American National Standard

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Specification for Torch Brazing

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

American Welding Society®

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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 five independent specifications on brazing have been written, all in the same format. These are the present document, 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*; and 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 five specifications would cover the vast majority of brazing performed today.

There is not a direct conversion of the MIL-B-7883 Grades and the AWS Classes and the quality assurance requirements differ. The cancellation of MIL-B-7883 was not intended to add additional inspection requirements to legacy hardware (i.e., MIL-B-7883 Grade B with only external inspection was not intended to become AWS Class B with internal NDT requirements). Each Organization Having Quality Responsibility must provide instructions on how or if the cancellation is to be handled for their hardware.

After the completion of the brazing specifications, 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.

This fifth edition supersedes AWS C3.4M/C3.4:2016, bearing the same title. Revisions made to this edition were coordinated with changes in AWS C3.5M/C3.5 and AWS C3.6M/C3.6. Revisions were made throughout the document. Underlined text or a vertical line in the margin indicates a revision 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 Torch Brazing

1. General Requirements

1.1 Scope. This specification presents the minimum fabrication and quality requirements for the torch brazing of materials such as steels, stainless steels, copper, copper alloys, and heat- and corrosion-resistant alloys as well as other materials that can be adequately torch brazed. Note that the torch brazing of aluminum alloys is addressed in AWS C3.7M/C3.7, *Specification for Aluminum Brazing*.

The purpose of this specification is to standardize torch brazing process requirements and brazed joint quality requirements for all applications requiring brazed joints of assured quality. This document establishes minimum requirements for processes and products with minimum 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 Order of Authority. The brazing process shall be subjected to the following order of authority, least-to-highest: this specification, assembly drawing, contract or purchase order, and the Organization Having Quality Responsibility (OHQR). That is, the final responsibility for all aspects of the brazing process (including, but not limited to, materials, equipment, heating cycle, calibration, etc.) and brazed assembly quality (including, but not limited to, inspection methods, inspection criteria, rework, etc.) rests with the OHQR. The OHQR has the authority to make any modifications to the requirements document(s) and to stipulate those modifications to the brazing operator. Any such modifications shall be fully documented by the OHQR.

1.3 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.

1.4 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:

(1) United States Department of Labor, Occupational Safety & Health Administration (OSHA)

(2) Equivalent agencies of other countries and individual states

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.

See 5.6 for supplemental safety and health information.

1.5 Ordering Information. The purchaser shall provide the following information to the brazer:

(1) Parent metal alloy and condition

(2) Brazing Filler Metal

1.5.1 The following information is optional or has default requirements in this document; therefore, the purchaser may specify alternate requirements:

(1) Brazed joint classification (Clause 4)

(2) Cosmetic criteria

(3) Fillet size

(4) Areas to be free of excess brazing filler metal

(5) Flux type or restrictions on use of flux

(6) Heating or cooling rates

(7) Postbraze heat treatment

(8) Pre- or postbraze cleaning methods

(9) Method of nondestructive examination

(10) Name of the Organization Having Quality Responsibility

(11) Part number and quantity of parts

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*

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 A5.8M/A5.8, *Specification for Filler Metals for Brazing and Braze Welding*

AWS A5.31M/A5.31, *Specification for Fluxes for Brazing and Braze Welding*

AWS B2.2/B2.2M, *Standard for Brazing Procedure and Performance Qualification*

AWS C3.3, *Recommended Practices for the Design, Manufacture, and Examination of Critical Brazed Components*

AWS C3.8M/C3.8, *Specification for the Ultrasonic Pulse-Echo Examination of Brazed Joints*

AWS C3.14M/C3.14, *Standard Method for Evaluation of Brazed Joints Using Visual and Metallographic Techniques*

American National Standards Institute (ANSI) document:

ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

American Society for Quality (ASQ) standard:

ASQ Z1.4, *Sampling Procedures and Tables for Inspection by Attributes*

Society of Automotive Engineers (SAE) documents:

SAE AMS 2403, *Plating, Nickel General Purpose*

SAE AMS 2404, *Plating, Electroless Nickel*

SAE AMS 2424, *Plating, Nickel Low-Stressed Deposit*

SAE AMS 2451/1, *Plating, Brush, Nickel, General Purpose*

SAE AMS 2451/7, *Plating, Brush, Nickel Low Stress, Medium-Hardness Deposit*

SAE AMS 2750, *Pyrometry*

ASTM International standards:

ASTM E230/E230M, *Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples*

ASTM E1742/E1742M, *Standard Practice for Radiographic Examination*

ASTM E1417/E1417M, *Standard Practice for Liquid Penetrant Examination*

International Organization for Standardization (ISO) standard:

ISO/IEC 17025, *Testing and calibrating laboratories*

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.

braze joint. The total area, as defined by the engineering drawing, of the faying surfaces to be joined by brazing and the fillets that form at the edges of that area.

braze joint proper. The total area, as defined by the engineering drawing, of the faying surfaces to be joined by brazing, excluding any fillets that form at the edges of that area.

brazing procedure specification (BPS). A document specifying the required brazing variables for a specific application.

brazing symbol. The symbol on the engineering drawing designating the location, class, and configuration of the brazed joint. Such symbols shall be in accordance with AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination.*

joint dimensions. The joint length is the greater of the two dimensions of the joint parallel to the faying surfaces. The joint width is the lesser of these two dimensions of the joint. The clearance between the faying surfaces is the third dimension to be considered.

lack of bond. A condition in a brazed joint where although brazing filler metal is present between the faying surfaces, the filler metal does not adhere to or form a metallurgical bond with the base metal. It most commonly occurs when brazing filler metal is preplaced between contaminated faying surfaces.

load sensors. Sensors that are attached to or in contact with production material, a representation of production material, or are buried in the load of production material and which supply temperature data of the production material to process instrumentation.

Organization Having Quality Responsibility (OHQR). The organization responsible to the end user of the product for the quality of the product and its suitability for the intended use. This organization is usually the manufacturer and marketer of the final product in commercial business and the prime contractor in government procurement. Although such organizations may subcontract brazing and related operations to others, they cannot delegate the ultimate responsibility for the service suitability of the product to these subcontractors.