

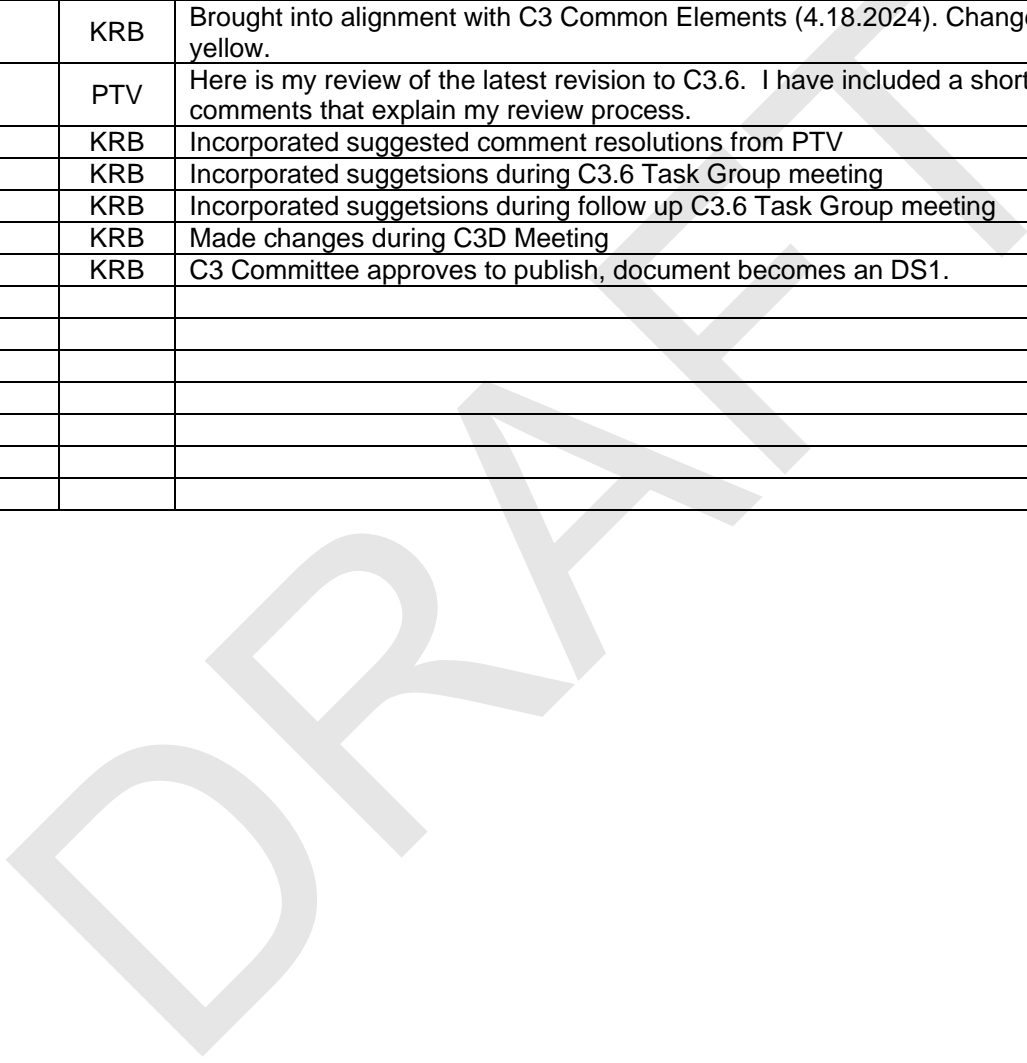


This is a working document under consideration by the AWS C3 Committee on Brazing and Soldering. It is made available solely to solicit comments from interested parties, and may not be relied upon or utilized for any other purpose. Draft documents may change significantly in subsequent versions.

**DOCUMENT SUMMARY PAGE**

*C3.6M/C3.6:202X, Specification for Furnace Brazing*

<b>Date</b>	<b>Initials</b>	<b>Action</b>
09/18/2020	KRB	Prepared Preliminary Draft
06/07/2022	PTV	Revisions submitted by Paul Vianco via email on June 7, 2022
05/24/2023	KRB	Added D17.1 (1.2 Order of Authority) and D20.1 (4.1 Classification of Brazed Joints) text, which will be reworded by PTV
06/03/2023	PTV	Revisions submitted by Paul Vianco via email on June 3, 2023
05/09/2024	KRB	Brought into alignment with C3 Common Elements (4.18.2024). Changes highlighted in yellow.
07/05/2024	PTV	Here is my review of the latest revision to C3.6. I have included a short list of general comments that explain my review process.
12/02/2024	KRB	Incorporated suggested comment resolutions from PTV
12/10/2024	KRB	Incorporated suggestions during C3.6 Task Group meeting
12/16/2024	KRB	Incorporated suggestions during follow up C3.6 Task Group meeting
03/27/2025	KRB	Made changes during C3D Meeting
03/28/2025	KRB	C3 Committee approves to publish, document becomes an DS1.





This is a working document under consideration by the AWS C3 Committee on Brazing and Soldering.  
It is made available solely to solicit comments from interested parties, and may not be relied upon or utilized for any other purpose.  
Draft documents may change significantly in subsequent versions.

**AWS C3.6M/C3.6:202X**  
**An American National Standard**

**Approved by**  
**American National Standards Institute**  
**MM/DD/YYYY**

**Specification for**  
**Furnace Brazing**

**5th Edition**

**Revises AWS C3.6M/C3.6:2016**

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, process and procedure requirements, as well as inspection requirements for the furnace brazing of steels, copper, copper alloys, and heat- and corrosion-resistant alloys and other materials that can be adequately furnace brazed (the furnace brazing of aluminum alloys is addressed in AWS C3.7M/C3.7, *Specification for Aluminum Brazing*). This specification provides criteria for classifying furnace 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 furnace brazing equipment, materials, and procedures, as well as the required inspection for each class of joint.





This is a working document under consideration by the AWS C3 Committee on Brazing and Soldering.  
It is made available solely to solicit comments from interested parties, and may not be relied upon or utilized for any other purpose.  
Draft documents may change significantly in subsequent versions.

DRAFT

ISBN Print: XXX-X-XXXXX-XXX-X  
ISBN PDF: XXX-X-XXXXX-XXX-X

©202X 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).



This is a working document under consideration by the AWS C3 Committee on Brazing and Soldering. It is made available solely to solicit comments from interested parties, and may not be relied upon or utilized for any other purpose. Draft documents may change significantly in subsequent versions.

## 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 revised, 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, 8669 NW 36 St, # 130, Miami, FL 33166 (see Annex B). 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 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.



This is a working document under consideration by the AWS C3 Committee on Brazing and Soldering. It is made available solely to solicit comments from interested parties, and may not be relied upon or utilized for any other purpose. Draft documents may change significantly in subsequent versions.

# **Personnel**

[To be inserted at typesetting]

## **AWS C3 Committee on Brazing and Soldering**

**Advisors to the AWS C3 Committee on Brazing and Soldering**

## **AWS C3D Subcommittee on Brazing Specifications**

**Advisors to the AWS C3D Subcommittee on Brazing Specifications**

DRAFT



This is a working document under consideration by the AWS C3 Committee on Brazing and Soldering. It is made available solely to solicit comments from interested parties, and may not be relied upon or utilized for any other purpose. Draft documents may change significantly in subsequent versions.

## Foreword

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

This specification is one ~~of in~~ 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 that address the critical brazing processes: 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*; ~~the present document;~~ AWS C3.6M/C3.6, *Specification for Furnace Brazing*; AWS C3.7M/C3.7, *Specification for Aluminum Brazing*; and C3.9M/C3.9, *Specification for Resistance Brazing*.

The decision to subdivide the technology in this ~~way manner~~ 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 correlation between these five specifications and the cancelled of the~~ MIL-B-7883, ~~Grades and the AWS Classes and the quality assurance requirements differ. If the latter document was in use at by the supplier, then the corresponding~~ 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 guidance towards transitioning to the AWS specification on how or if the cancellation is to be handled for their each hardware product.

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 ~~fourth-fifth~~ edition supersedes AWS C3.6M/C3.6: ~~2007~~ 2016, bearing the same title. Revisions made to this edition were coordinated with changes in AWS C3.4M/C3.4 and AWS C3.5M/C3.5, incorporating many of the improvements in the 2011 edition of AWS C3.7M/C3.7, and coordinating the wording between the three documents. Revisions were made throughout the document.

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.



# Table of Contents

Page No.

*Personnel* . . . . .

*Foreword* . . . . .

**1. General Requirements** . . . . .

    1.1 Scope . . . . .

    1.2. Order of Authority . . . . .

    1.32 Units of Measurement . . . . .

    1.43 Safety . . . . .

    1.54 Ordering Information . . . . .

**2. Normative References** . . . . .

**3. Terms and Definitions** . . . . .

**4. Classification of Brazed Joints** . . . . .

    4.1 ~~Method of~~ Classification of Brazed Joints . . . . .

    4.2 Class A—Critical Application Joints . . . . .

    4.3 Class B—Semi-Critical Joints . . . . .

    4.4 Class C—Noncritical Application Joints . . . . .

    4.5 No Class Specified . . . . .

**5. Process Requirements** . . . . .

    5.1 Process Description . . . . .

    5.2 Equipment . . . . .

    5.3 Materials . . . . .

    5.4 Procedure Requirements . . . . .

    5.5 Brazing Procedure Specification (BPS) Qualification . . . . .

    5.6 Safety and Health—Supplemental . . . . .

**6. Quality Assurance Provisions** . . . . .

    6.1 Responsibility for Inspection . . . . .

    6.2 Requirements for Compliance . . . . .

    6.3 Inspection Personnel Qualification . . . . .

    6.4 Sequence of Inspection and Manufacturing Operations . . . . .

    6.5 Required Inspection of Brazed Joints . . . . .

    6.6 Acceptance Criteria . . . . .

    6.7 Process Completion . . . . .

Annex A (Informative)—Informative References . . . . .

Annex B (Informative)—Requesting an Official Interpretation on an AWS Standard . . . . .

List of AWS Documents on Brazing and Soldering . . . . .



# Specification for Furnace Brazing

## 1. General Requirements

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

The purpose of this specification is to standardize furnace brazing process requirements and brazed joint quality requirements for all applications ~~requiring brazed joints of assured quality~~ quality assurance. This document establishes minimum requirements for the furnace brazing processes and products resulting braze joint with ~~a minimum of~~ limited explanatory information ~~so that sources of~~ to minimize ambiguity ~~are minimized~~.

**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~~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 in brackets ([ ]) or in ~~appropriate separate~~ in within tables and figures. The measurement pairs may not be exact equivalents due to round-off to significant figures. The preferred approach is to use one, or the other units of measurements consistently within each application's drawings, process control documentation, and inspection charts.; ~~therefore each system must be used independently.~~

**1.4~~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:

- (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