AWS C3.14M/C3.14:2020
An American National Standard

Standard Method for Evaluation of Brazed Joints Using Visual and Metallographic Techniques

American Welding Society®

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Standard Method for Evaluation of Brazed Joints Using Visual and Metallographic Techniques

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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 standard describes and illustrates the test methods used to obtain information related to brazed joint quality and structural integrity. Verification methods include visual observation, as well as metallography of such parameters as braze wetting, braze joint erosion, brazing filler metal penetration, differences between excess wetting, lack of wetting and dewetting, and formation of voids, cracks, and features which may be detrimental to end use. Additionally, methods to determine diffusion of braze alloying elements and procedures to qualify such methods are described. Photographs illustrating visual inspection, schematic illustrations, and photomicrographs illustrating various aspects of brazed joint integrity are presented.

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Foreword

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

Currently there are no industry standards or guidelines for the evaluation of brazed joint external (visual) and internal (microstructural) features. Aerospace prime contractors are faced with increasing demand for third-party accreditation of suppliers for various brazing processes; yet are faced with a lack of a reliable method for assessing the supplier skills and capabilities in this area. This standard is intended to provide a vehicle for third party assessment of supplier capabilities by including test methods and criteria for evaluating brazed joint quality. This standard is intended to complement the AWS C3.2M/C3.2, *Standard Method for Evaluating the Strength of Brazed Joints*. By effective use of both of these standards one can obtain a complete assessment of brazed joint quality, both mechanical (strength—AWS C3.2) as well as metallurgical (AWS C3.14). Both standards are intended to serve as guidelines and contain best practices. Their use as a governing, requirement document is left to the discretion of the Organization Having Quality Responsibility and the various agencies employing the methods described herein.

A Commentary Annex on AWS C3.14M/C3.14:2020 has been prepared to generate a better understanding in the application of this specification in visual and metallographic evaluation of brazed joints, and is included for informational purposes only.

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

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.

NOTE: The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights.

By publication of this standard, no position is taken with respect to the validity of any such claim(s) or of any patent rights in connection therewith. If a patent holder has filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, then details may be obtained from the standard developer.

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1. General Requirements

1.1 Scope. This standard describes the test methods used to obtain reliable data related to external braze features and microstructural information to ensure compliance to the requirements of the following braze processes: Torch Brazing, Induction Brazing, Furnace Brazing, Resistance Brazing, Dip Brazing, Infrared Brazing, and Diffusion Brazing.

This standard also covers evaluation of joints, prepared and brazed according to a Brazing Procedure Specification and the applicable brazing specification utilizing samples that are representative of the part, or an actual part, at the discretion of the Organization Having Quality Responsibility (OHQR) or the Organization Performing the Brazing Operation (OPBO). Evaluation may be performed using external visual inspection, various metallographic techniques, and destructive testing such as peel testing.

Figures and illustrations are included wherever appropriate to clarify the expectations and interpretations of the data. This document provides information to assist in standardizing the evaluation and interpretation of brazed joint features but the acceptability of those features will be governed by the applicable brazing process specification, engineering drawing requirements, and the OHQR.

1.2 Units of Measurement. This standard does not require units of measure. Therefore, no equivalents or conversions are contained except when they are cited in examples.

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.