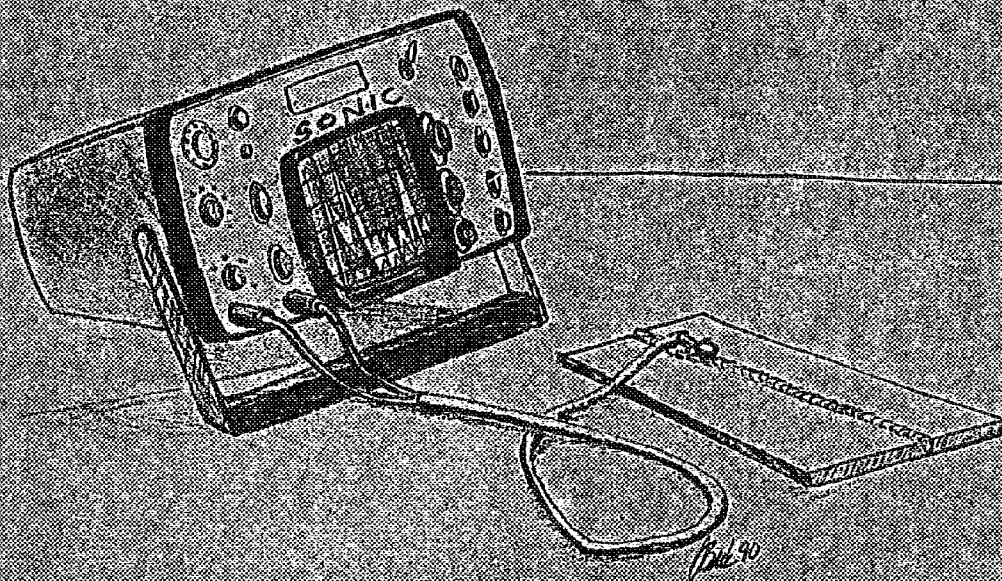


ANSI/AWS C3.8-90
An American National Standard

Recommended Practices for Ultrasonic Inspection of Braze Joints



American Welding Society

Keywords— Ultrasonic inspection, brazed joint defects, brazing, torch brazing, induction brazing, aluminum brazing, furnace brazing, quality control inspection of brazed joints, ultrasonic inspection, brazed joint, defects, nondestructive testing

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Recommended Practices for Ultrasonic Inspection of Brazed Joints

Prepared by
AWS Committee on Brazing and Soldering

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This recommended practices presents minimum fabrication, equipment, and process procedure requirements for the ultrasonic inspection of brazed joints. Its purpose is to standardize brazed joint ultrasonic inspection requirements for all applications where brazed joints of assured quality are required. It provides minimum requirements for equipment, procedures, and documentation of such tests.



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Foreword

(This Foreword is not a part of ANSI/AWS C3.8-90, *Recommended Practices for Ultrasonic Inspection of Brazed Joints*, but is included for information purposes only.)

This specification is one of a series prepared at the request of the Aerospace Manufacturers Association and a number of others to replace MIL-B-7883. That one specification covered all brazing processes. It had become both obsolete and very cumbersome as brazing technology proliferated and became more complex. Attempting to cover all of the diverse brazing processes in one concise, easily understood document was found to be impossible, and therefore, a series of four independent specifications on brazing were written, all in the same format. They are the specifications on torch brazing, furnace brazing, induction brazing, and aluminum brazing. It was decided to subdivide the technology in this way based upon a survey of production brazing applications conducted by the AWS Committee on Brazing and Soldering. This showed that these four specifications would cover the vast majority of brazing done in the United States today.

This document is the fifth specification in the series. It was written because in the preparation of the four brazing specifications it was found that no such document existed which could be referenced by them to provide specific criteria and requirements for the application of this important new technology to brazed joints.

Official interpretations of any of the technical requirements of this specification may be obtained by sending a request, in writing to the Technical Director, American Welding Society. A formal reply will be issued after it has been reviewed by appropriate personnel following established procedures.

Comments and inquiries concerning the document are welcome. They should be addressed to the Secretary, Committee on Brazing and Soldering, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135.

Table of Contents

	Page No.
<i>Personnel</i>	iii
<i>Foreword</i>	v
<i>1. Scope</i>	1
<i>2. Applicable Documents</i>	1
<i>3. Requirements</i>	1
3.1 Ultrasonic Testing Equipment	1
3.2 Accessory Equipment	1
3.3 Required Procedures	2
<i>4. Acceptance Criteria</i>	2
<i>5. Definition</i>	2
<i>AWS Brazing and Soldering Documents</i>	(Inside back cover)

Recommended Practices for Ultrasonic Inspection of Brazed Joints

1. Scope

This document presents minimum equipment and procedure requirements for the ultrasonic inspection of brazed joints.

2. Applicable Documents

The following documents are applicable to the ultrasonic inspection of brazed joints

- (1) ASNT TC-1A *Recommended Practice — Personnel Qualification and Certification in Nondestructive Testing*¹
- (2) AWS C3.4-90, *Specification for Torch Brazing*²
- (3) AWS C3.5-90, *Specification for Induction Brazing*
- (4) AWS C3.6-90, *Specification for Furnace Brazing*
- (5) AWS C3.7-90, *Specification for Aluminum Brazing*
- (6) MIL-STD-410 *Nondestructive Testing, Personnel Qualification and Certification*³

3. Requirements

3.1 Ultrasonic Testing Equipment. The ultrasonic test instrument shall be capable of transmitting, receiving, and displaying high frequency electrical pulses using transducers at the required frequencies and amplitudes necessary to perform the required inspection. When specified by the Organization Having Quality Responsi-

bility (see section 5, Definitions) calibrated attenuators and flaw gates with alarms and recorders shall be used. All equipment shall be suitable for the intended purpose and in good working order.

3.2 Accessory Equipment

3.2.1 Tank. The tank for immersion testing shall be of sufficient size to permit the submersion of the brazed part or the entire braze joint area of the assembly and the search unit such that the required inspection can be performed.

3.2.2 Turntable. A turntable shall be used to rotate circular assemblies during ultrasonic inspection. It shall be suitable for the intended purpose.

3.2.3 Bridge. The bridge shall be mounted over the tank and shall move smoothly over the working area of the tank. The bridge shall be capable of being accurately indexed manually or automatically, or both, as required to interrogate the braze joint area of the assembly.

3.2.4 Carriage. The carriage shall be mounted on the bridge and shall support the manipulator. It shall have uniform, smooth operation over its working distance and shall be capable of traversing manually or automatically, or both, as required to interrogate the braze joint area of the assembly.

3.2.5 Manipulator. The manipulator shall be rigidly attached to the carriage, shall support the search unit, and shall provide fine angular adjustment in two planes at right angles to each other.

3.2.6 Transducers. Transducers shall be capable of converting electrical energy into acoustic energy and vice versa (piezo electric). They shall be capable of transmitting and receiving ultrasonic energy in the material being tested at the required frequency and energy level. A variety of sound beams ranging from columnated to focused may be used, but the beam selected shall be suitable for the intended purpose.

1. ASNT documents are available from the American Society for Nondestructive Testing, 4153 Arlington Plaza, Columbus, Ohio 43228.

2. AWS specifications may be obtained from the American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135.

3. Military specifications may be obtained from the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

3.2.7 Recorder. A device capable of producing a C-Scan facsimile of the braze joint is required for immersion testing of all brazed joints unless otherwise specified on the approved ultrasonic inspection procedure. (See 3.3.3.)

3.2.8 Alarm. When a facsimile recorder is not used, an audible electronic defect alarm or stop-on-defect alarm shall be used.

3.2.9 Reference Standards. Reference standards shall be made of the same base and filler materials as the brazed joints to be inspected. The brazed joint shall be at the same distance and orientation to the front and rear surfaces as those in the components to be inspected. It also shall have defects of known location and size suitable for calibration of the inspection system. The physical dimensions of the reference standards shall be specified by the Organization Having Quality Responsibility.

3.2.10 Couplants. Couplants shall permit the efficient transmission of ultrasonic energy between the transducer and the surface of the component being inspected. For water immersion testing, rust inhibitors and wetting agents may be added. The couplant and any additives shall not be detrimental to the brazed products being inspected.

3.3 Required Procedures

3.3.1 Operator Qualification. Ultrasonic operators shall be qualified as specified by MIL-STD-410 or ASNT TC-1A, Level II or III.

3.3.2 Preparation of Brazed Assemblies for Testing. All brazed assemblies requiring ultrasonic testing shall be of a configuration suitable for testing. The outer surface through which the sonic energy enters and leaves the part shall be parallel to the brazed joint surfaces. The surface shall have no steps, lands, slots, holes, braze filler material, or stop-off located so as to prevent the proper interrogation of the joint. The finish of this surface shall be 125 RMS maximum.

3.3.3 Documentation. A written ultrasonic procedure specifying the equipment to be used, and the techniques to be used to calibrate the equipment and inspect the assemblies shall be required. This procedure shall also specify how the assemblies shall be identified and how the test results shall be documented. This procedure shall be approved in writing by the Organization Having Quality Responsibility for the product.

3.3.4 Inspection Technique

3.3.4.1 Contact Method. Search unit qualification tests shall establish the sound beam characteristics of the transducer and demonstrate its ability to detect the known defects in the reference standard. The sound beam entry angle and the testing mode shall be established as part of the development of the approved procedure and shall not be modified unless a procedure requalification is done. If wear of the contact shoes or search unit results in a change in the sound beam entry angle of more than 0.052 radians (3 degrees) from the approved procedure, or if the transducer contact face has been nicked or serrated, the search unit shall be either replaced or repaired. Such a repaired or replaced transducer shall be requalified to demonstrate its ability to detect the known defects in the reference standard.

3.3.4.2 C-Scan Immersion Method. When C-Scan techniques are used to inspect brazed joints, the beam entry angle shall be adjusted perpendicular to the part surface. During testing, the angle shall not vary more than 0.035 radians (2 degrees) nor shall the water path length vary more than 0.2 in. (5 mm) from the distance specified by the approved procedure. The scanning index increment shall not exceed 0.04 in. (1 mm). The scanning speed shall be such that the defects in the reference standard are clearly discernible on the facsimile without image distortion or blurring.

4. Acceptance Criteria

Acceptance criteria for interpreting the results of ultrasonic tests of brazed joints shall be as specified by the relevant AWS brazing process specification unless otherwise specified by the engineering drawing.

5. Definition

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

AWS Brazing and Soldering Documents

Designation	Title
BRM	Brazing Manual
SM	Soldering Manual
0.08	Soldering in Electronics—Second Edition by R. J. Klein-Wassink
C3.2	Standard Method for Evaluating the Strength of Brazed Joints in Shear
C3.3	Recommended Practices for Design, Manufacture, and Inspection of Critical Brazed Components
C3.4	Specification for Torch Brazing
C3.5	Specification for Induction Brazing
C3.6	Specification for Furnace Brazing
C3.7	Specification for Aluminum Brazing (Available July 1990)
C3.8	Recommended Practices for Ultrasonic Inspection

For additional information contact the Order Department, The American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135, Phone (305) 443-9353.