

AWS B4.0:2007
An American National Standard



Standard Methods for Mechanical Testing of Welds



American Welding Society



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Standard Methods for Mechanical Testing of Welds

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Prepared by the
American Welding Society (AWS) B4 Committee on Mechanical Testing of Welds

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

Mechanical test methods that are applicable to welds and welded joints are described. For each testing method, information is provided concerning applicable American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), and American Petroleum Institute (API) documents; the required testing apparatus, specimen preparation, procedure to be followed, and report requirements are also described.



American Welding Society

550 N.W. LeJeune Road, Miami, FL 33126

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Dedication

Henry Hahn

The AWS B4 Committee on Mechanical Testing of Welds dedicates this edition of AWS B4.0, *Standard Methods for the Mechanical Testing of Welds*, to the memory of Henry H. Hahn. Henry was an active and productive member and past Chair of the AWS B4 Committee on Mechanical Testing of Welds, a past Chair of ISO/TC44/SC5, past Chair of ISAC-05, and a former member of the AWS Technical Activities Committee and AWS International Standards Activities Committee.

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Personnel

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Advisors to the AWS B4 Committee on Mechanical Testing of Welds

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E. L. Lavy	<i>Consultant</i>
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H. W. Mishler	<i>Consultant</i>
G. R. Pearson	<i>Anderson Laboratories</i>
A. G. Portz	<i>Consultant</i>
W. W. St. Cyr, II	<i>NASA</i>

*Deceased

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Foreword

This foreword is not part of AWS B4.0:2007, *Standard Methods for Mechanical Testing of Welds*, but is included for informational purposes only.

This standard covers the common tests for the mechanical testing of welds. They are defined and illustrated in sections related to tension tests, shear tests, bend tests, fracture toughness tests, hardness tests, break tests (nick and fillet welds), selected weldability tests and process specific tests (stud weld tests and resistance weld tests).

This document extensively uses American Society for Testing and Materials (ASTM) Standard Methods and specifies how to use these methods when testing weldments. It takes into consideration the variations in properties that can occur between different regions (base metal, heat-affected zone, and weld metal) of a weldment.

Methods of hardness testing and mechanical property tests for base metals are covered by ASTM standards or the individual material specification. The joint tests for brazements are covered in ANSI/AWS C3.2, *Standard Methods for Evaluating the Strength of Brazed Joints in Shear*. Additional information on the mechanical testing of welded joints may be obtained from the AWS Welding Handbook, Volume 1, which describes selected weldability test methods.

AWS B4.0:2007, *Standard Methods for the Mechanical Testing of Welds*, is the seventh edition of the document initially published in 1942. The second edition (1974) incorporated metric conversions and the third edition (1977) incorporated minor changes. The fourth edition (1985) added the plane-strain fracture toughness test and the fifth edition (1992) added hardness testing and stud weld tests, and organized the tests by weld type. The sixth edition (1998) added six new weldability tests, and the current edition includes three new weldability tests (WIC, trough, and GBOP) and resistance weld tests. Previous editions of the document are as follows:

AWS A4.0-42, *Standard Methods for Mechanical Testing of Welds*

AWS B4.0-74, *Standard Methods for Mechanical Testing of Welds*

AWS B4.0-77, *Standard Methods for Mechanical Testing of Welds*

AWS B4.0-85, *Standard Methods for Mechanical Testing of Welds*

AWS B4.0-92, *Standard Methods for Mechanical Testing of Welds*

AWS B4.0-98, *Standard Methods for Mechanical Testing of Welds*

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS B4 Committee on Mechanical Testing of Welds, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

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Standard Methods for Mechanical Testing of Welds

1. Scope

This specification establishes standard methods for mechanical testing of welds. The significance of each test, test apparatus, preparation of the test specimens, and the test procedure are described. Example test results sheets are provided.

It is beyond the scope of this document to define the required mechanical properties or acceptance criteria for the weld metal.

This standard makes sole use of U.S. Customary Units. Approximate mathematical equivalents in the International System of Units (SI) are provided for comparison in parentheses or in appropriate columns in tables and figures.

Safety and health issues and concerns are beyond the scope of this standard and therefore are not fully addressed herein. Safety and health information is available from other sources, including, but not limited to, ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, and applicable federal, state, and local regulations.

2. Normative References

The following standards contain provisions which, through reference in this text, constitute mandatory provisions of this AWS standard. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

AWS documents:¹

AWS A1.1, *Metric Practice Guide for the Welding Industry*;

¹ AWS standards are published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

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

AWS A3.0, *Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*.

3. Terms and Definitions

The welding terms used in this standard are in accordance with AWS A3.0, *Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*.

4. Tension Tests

4.1 Scope. This clause covers the tension testing of welded joints. It does not specify required properties or acceptance criteria. When this standard is used as a portion of specification for a welded structure or assembly or for qualification, the following information shall be furnished:

- (1) The specific type(s) and number of specimens required,
- (2) Base metal specification/identification,
- (3) Filler material specification/identification,
- (4) The anticipated property values and whether they are maximum or minimum requirements,
- (5) Location and orientation of the specimens,
- (6) Report form when required, and
- (7) Postweld thermal or mechanical processing treatments, as applicable.

This standard is applicable to the following, when specified:

- (1) Qualification of materials and welding procedures where specified mechanical properties are required,