

Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding



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An American National Standard**

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American National Standards Institute
November 12, 1992**

Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding

Supersedes ANSI/AWS A4.3-86

Prepared by the
American Welding Society (AWS) A5 Committee on Filler Metal

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

A standard $25 \times 12 \times 80$ mm test specimen and method of preparation are set forth, along with two standard methods of diffusible hydrogen analysis, mercury displacement and gas chromatography. The methods are suitable for shielded metal arc welding, gas metal arc welding, flux cored arc welding, and submerged arc welding using welding conditions and electrodes given in several applicable American Welding Society filler metal specifications.



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Foreword

This foreword is not part of ANSI/AWS A4.3-93 (R2006), *Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding*, but is included for informational purposes only.

This document (A4.3-93) refers to an IIW draft standard for measurement of diffusible hydrogen in several places, including the foreword and the appendix. This referenced IIW draft became the basis for ISO 3690:2000.

A number of test methods for determining weld metal diffusible hydrogen have been used over the years. In particular, media for collecting hydrogen have included glycerin, paraffin, and mercury, with glycerin being by far the most popular in the United States. A previous AWS A5 Task Group, chaired by R. A. LaFave, investigated the collection of hydrogen over glycerin in 1982–1983. That Task Group concluded that, whereas collection of hydrogen over glycerin is simple and inexpensive, the results suffer from severe variability. This is due in part to the solubility of water, atmospheric gases, and hydrogen in glycerin.

Collection of hydrogen over glycerin, when using very low hydrogen weld metals, has also been shown to give null readings, while collection over mercury using the method of ISO 3690 was giving readings greater than zero. The method of ISO 3690 is only suitable for coated electrodes. Recognizing this, the International Institute of Welding (IIW) has been developing a draft standard with a larger specimen size suitable for other welding processes but still using collection of hydrogen over mercury as the reference method. This draft has also introduced analysis by gas chromatography as giving results equal to those of collection over mercury.

The AWS A5 Task Group, in 1983 and 1984, chaired by D. J. Kotecki, considered adopting the method of the IIW draft standard. However, after round robin testing employing the IIW specimen size and other sizes, the Task Group rejected the IIW specimen size for two reasons. First, the small size required reorientation of the test specimen depending upon welding heat input. Second, the small size resulted in hydrogen volumes almost too small to measure when very low hydrogen weld metals were tested. As a result, the Task Group selected a specimen size appropriate to generating a significant volume of hydrogen gas for measurement and not requiring specimen reorientation for welding heat input within the realm of electrode classifications envisioned for use with this standard.

This is the first revision of this specification as shown below:

ANSI/AWS A4.3-86, *Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding*.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS A5 Committee on Filler Metal, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126. Official interpretations of any of the technical requirements of this standard may only be obtained by sending a request, in writing, to the Managing Director, Technical Services Division, American Welding Society. A formal reply will be issued after it has been reviewed by the appropriate personnel following established procedures.

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