

AWS A5.24/A5.24M:2023
An American National Standard

Specification for Zirconium and Zirconium-Alloy Welding Electrodes and Rods



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An American National Standard

Approved by the
American National Standards Institute
September 12, 2022

Specification for

Zirconium and Zirconium-Alloy

Welding Electrodes and Rods

6th Edition

Revises AWS A5.24/A5.24M:2014

Prepared by the
American Welding Society (AWS) A5 Committee on Filler Metals and Allied Materials

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This specification prescribes the requirements for classification of zirconium and zirconium-alloy electrodes and rods for gas metal arc welding, gas tungsten arc welding, and plasma arc welding. The compositions specified for each classification represent the latest state-of-the-art. Additional requirements are included for testing procedures, manufacture, sizes, lengths, and packaging. A guide is appended to the specification as a source of information concerning the classification system employed and the intended use of the zirconium-alloy welding electrodes and rods.

This specification makes use of both U.S. Customary Units and the International System of Units (SI). Since these are not equivalent, each system must be used independently of the other.



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Foreword

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

This document makes use of both U.S. Customary Units and the International System of Units (SI). The measurements are not exact equivalents; therefore each system must be used independently of the other, without combining values in any way. In selecting rational metric units, AWS A1.1, *Metric Practice Guide for the Welding Industry* is used where suitable. Tables and figures make use of both U.S. Customary and SI Units which, with the application of the specified tolerances, provide for interchangeability of products in both U.S. Customary and SI Units.

The current document is the sixth revision of the initial joint ASTM/AWS document issued in 1976. The evolution took place as follows:

AWS A5.24-76	<i>Specification for Zirconium and Zirconium Alloy Bare Welding Rods and Electrodes</i>
AWS A5.24-79	<i>Specification for Zirconium and Zirconium Alloy Bare Welding Rods and Electrodes</i>
ANSI/AWS A5.24-90	<i>Specification for Zirconium and Zirconium Alloy Welding Rods and Electrodes</i>
ANSI/AWS A5.24-97R	<i>Specification for Zirconium and Zirconium Alloy Welding Rods and Electrodes</i> , reaffirmed in 1997
AWS A5.24/A5.24M:2005	<i>Specification for Zirconium and Zirconium Alloy Welding Rods and Electrodes</i>
AWS A5.24/A5.24M:2014	<i>Specification for Zirconium and Zirconium-Alloy Welding Rods and Electrodes</i>
AWS A5.24/A5.24M:2023	<i>Specification for Zirconium and Zirconium-Alloy Welding Rods and Electrodes</i>

The first Specification for Zirconium and Zirconium Bare Welding Rods and Electrodes, prepared by the Subcommittee on Zirconium Filler Metal, originally had three electrode classifications: ERZr1, ERZr2, and ERZr3. In the 1979 edition, the very pure grade of zirconium (ERZr1) was deleted and an additional grade, ERZr4 (with 2%–3% Niobium), was added to the specification. It included an addition to the check analysis tolerance by the joint AWS Subcommittee on Titanium and Zirconium Filler Metals. In 1990, the specification was revised to include the Acceptance and Certification clauses to the appendix. In 2005, the specification was revised to include an oxygen range for all electrode classifications. This was done to take into account the oxygen pickup during the zirconium welding process in order to create final weld strength similar to that of the parent metal. Additionally, AWS A5.24:2005 was the first to use both the U.S. Customary Units and the International System Units (SI). AWS A5.24/A5.24M:2014, *Specification for Zirconium and Zirconium-Alloy Welding Electrodes and Rods*, was the fifth revision of the document. It primarily included updates to the reference documents.

Substantive changes in this revision include the following:

- Updated language for rules of Acceptance and Certification
- New ASTM references for chemical analysis
- Additional clarification about retests and process if a sample is invalid
- UNS numbers for ERZr2, ERZr3, and ERZr4 revised
- AWS A5.02/A5.02M now definitive source for standard sizes, identification, finish, uniformity, and packaging
- Compliance with current A5 standards guidelines

These substantive changes are shown in italic font.

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 standards developer.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS A5 Committee on Filler Metals and Allied Materials, American Welding Society, 8669 NW 36 St, #130, Miami, FL 33166.

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

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Specification for Zirconium and Zirconium-Alloy Welding Electrodes and Rods

1. Scope

1.1 This specification prescribes requirements for the classification of zirconium and zirconium-alloy electrodes and rods for gas metal arc, gas tungsten arc, and plasma arc welding.

1.2 This specification makes use of both U.S. Customary Units and the International System of Units (SI). The measurements *are* not exact equivalents; therefore, each system must be used independently *of the other, without combining values in any way when referring to material properties. The specification with the designation A5.24 uses U.S. Customary Units. The specification A5.24M uses SI Units.* The latter are shown within brackets [] or in appropriate columns in tables. *Standard dimensions based on either system may be used for sizing of electrodes or packaging or both under A5.24 or A5.24M specifications.*

1.3 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. Some safety and health information can be found in Annex Clauses A5 and A10.* 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 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.

2. Normative References

The documents listed below are referenced within this publication and are mandatory to the extent specified herein. Unless otherwise defined in this document, welding terms are as defined in AWS A3.0M/A3.0. 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.