



Standard Specification for Hot-Rolled and Cold-Finished Zirconium and Zirconium Alloy Bars, Rod, and Wire for Nuclear Application¹

This standard is issued under the fixed designation B351/B351M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers four grades of wrought zirconium and zirconium alloy bars, rod, and wire as follows:

- 1.1.1 *R60001*—Unalloyed grade,
- 1.1.2 *R60802*—Zirconium-Tin alloy (Zircaloy 2),
- 1.1.3 *R60804*—Zirconium-Tin alloy (Zircaloy 4), and
- 1.1.4 *R60901*—Zirconium-Niobium alloy.

1.2 Unless a single unit is used, for example corrosion mass gain in mg/dm^2 , the values stated in either inch-pound or SI units are to be regarded separately as standard. The values stated in each system are not exact equivalents; therefore each system must be used independently of the other. SI values cannot be mixed with inch-pound values.

1.3 *The following precautionary caveat pertains only to the test method portions of this specification. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:²

B350/B350M Specification for Zirconium and Zirconium Alloy Ingots for Nuclear Application

E8/E8M Test Methods for Tension Testing of Metallic Materials

E21 Test Methods for Elevated Temperature Tension Tests of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E114 Practice for Ultrasonic Pulse-Echo Straight-Beam Contact Testing

¹ This specification is under the jurisdiction of ASTM Committee B10 on Reactive and Refractory Metals and Alloys and is the direct responsibility of Subcommittee B10.02 on Zirconium and Hafnium.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

E214 Practice for Immersed Ultrasonic Testing by the Reflection Method Using Pulsed Longitudinal Waves (Withdrawn 2007)³

G2/G2M Test Method for Corrosion Testing of Products of Zirconium, Hafnium, and Their Alloys in Water at 680°F (360°C) or in Steam at 750°F (400°C)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *annealed, n*—denotes material that exhibits a recrystallized grain structure.

3.2 *Lot Definition:*

3.2.1 *lot, n*—material of the same size, shape, condition, and finish produced from the same ingot or powder blend by the same reduction schedule and the same heat treatment parameters. Unless otherwise agreed between manufacturer and purchaser, a lot shall be limited to the product of a 12 h period for final continuous anneal, or to a single furnace load for final batch anneal.

3.3 *Forms Definitions:*

3.3.1 *bar, n:*

3.3.1.1 *rounds, squares and hexagons, n*— $\frac{3}{8}$ in. [9.5 mm] and over in diameter or size.

3.3.1.2 *flats, n*— $\frac{1}{4}$ to 10 in. [6.4 to 250 mm] inclusive in width and $\frac{1}{8}$ in. [3.2 mm] and over in thickness. Thickness $\frac{1}{8}$ in. [3.2 mm] to under $\frac{3}{16}$ in. [4.8 mm] can be cold-rolled strip as well as bar.

3.3.2 *rod, n*—rounds in coils for subsequent reworking $\frac{1}{4}$ to $\frac{3}{4}$ in. [6.4 to 19 mm] in diameter.

3.3.3 *wire, n*—material less than $\frac{3}{8}$ in. [9.5 mm] in diameter or size, in round, hexagonal, or octagonal cross section, furnished in coils or on spools or reels.

4. Ordering Information

4.1 Orders for materials under this specification shall include the following information as applicable:

4.1.1 Grade (see Section 1),

4.1.2 Dimensions and form (see 3.3),

³ The last approved version of this historical standard is referenced on www.astm.org.