



Designation: B353 – 12 (Reapproved 2017)

Standard Specification for Wrought Zirconium and Zirconium Alloy Seamless and Welded Tubes for Nuclear Service (Except Nuclear Fuel Cladding)¹

This standard is issued under the fixed designation B353; 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 seamless and welded wrought zirconium and zirconium-alloy tubes for nuclear application. Nuclear fuel cladding is covered in Specification B811.

1.2 Five grades of reactor grade zirconium and zirconium alloys suitable for nuclear application are described.

1.2.1 The present UNS numbers designated for the five grades are given in Table 1.

1.3 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.

1.4 *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.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

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.

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

B811 Specification for Wrought Zirconium Alloy Seamless Tubes for Nuclear Reactor Fuel Cladding

E8 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

E112 Test Methods for Determining Average Grain Size

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 *dimensions, n*—tube dimensions are outside diameter, inside diameter, and wall thickness. Only two of these parameters may be specified in addition to length, except minimum wall may be specified with outside and inside diameter. In each case, ovality and wall thickness variation (WTV) may be specified as additional requirements (see 3.1.5 and 3.1.6).

3.1.2 *hydride orientation fraction, F_n , n*—the ratio of hydride platelets oriented in the radial direction to the total hydride platelets in the field examined.

3.1.3 Lot Definitions:

3.1.3.1 *tubes, n*—a lot shall consist of a 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 an 8 h period for final continuous anneal, or to a single furnace load for final batch anneal.

3.1.4 *mill finish tubes, n*—tubes that have received all finishing operations subsequent to final anneal, which potentially affects tube mechanical, dimensional, or surface condition. These operations include, but are not limited to, pickling, cleaning, outer and inner surface abrasive conditioning, and straightening.