



Standard Specification for Wrought Titanium-3Aluminum-2.5Vanadium Alloy Seamless Tubing for Surgical Implant Applications (UNS R56320)¹

This standard is issued under the fixed designation F 2146; 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 the chemical, mechanical, and metallurgical requirements for wrought annealed or cold-worked and stress-relieved titanium-3aluminum-2.5vanadium alloy (UNS R56320) seamless tubing to be used in the manufacture of surgical implants. See Section 3 for size limitation.

1.2 The values stated in inch pound units are to be regarded as the standard. The SI equivalents in parentheses are for information only.

1.3 *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 requirements prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

E 8 Test Methods for Tension Testing of Metallic Materials²

E 120 Test Methods for Chemical Analysis of Titanium and Titanium Alloys³

E 1409 Test Method for Determination of Oxygen in Titanium and Titanium Alloys by the Inert Gas Fusion Technique⁴

E 1447 Test Method for Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity Method⁴

F 136 Specification for Wrought Titanium-6Aluminum-4Vanadium ELI (Extra Low Interstitial) Alloy (UNS R56401) for Surgical Implant Applications⁵

F 1472 Specification for Wrought Titanium-6Aluminum-4Vanadium Alloy (UNS R56400) for Surgical Implant Applications⁵

2.2 Aerospace Material Specifications:

AMS 2244 Tolerances, Titanium and Titanium Alloy Tubing⁶

AMS 2249 Chemical Check Analysis Limits, Titanium and Titanium Alloys⁶

AMS 2634 Ultrasonic Inspection, Thin Wall Metal Tubing⁶

AMS 4943 Titanium Alloy, Seamless, Hydraulic Tubing, 3.0A1-2.5V Annealed⁶

AMS 4944 Titanium Alloy, Seamless, Hydraulic Tubing, 3.0A1-2.5V Cold-Worked, Stress-Relieved⁶

2.3 ANSI Publication:

ANSI/ASME B46.1 Surface Texture, Surface Roughness Waviness and Lay⁷

2.4 American Society for Quality Standard:

ASQ C1 Specifications of General Requirements for a Quality Program⁸

2.5 Military Standard:

MIL-T-9047 Titanium and Titanium Alloy Bars (Rolled or Forged) and Reforging Stock, Aircraft Quality⁹

3. Classification

3.1 *Tubing*—Round product with an outside diameter greater than 0.250 in. (6.35 mm).

4. Ordering Information

4.1 Include with inquiries and orders for material under this specification the following information:

4.1.1 Quantity,

4.1.2 ASTM designation and date of issue,

4.1.3 Form (seamless tubing),

4.1.4 Condition (see 5.1),

4.1.5 Mechanical properties (if applicable, for special conditions),

4.1.6 Finish (see 5.2),

4.1.7 Applicable dimensions including outside diameter, wall thickness, length (exact, random, or multiples), or drawing number,

¹ This specification is under the jurisdiction of ASTM Committee F04 on Medical and Surgical Materials and Devices and is the direct responsibility of Subcommittee F04.12 on Metallurgical Materials.

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² *Annual Book of ASTM Standards*, Vol 03.01.

³ *Annual Book of ASTM Standards*, Vol 03.05.

⁴ *Annual Book of ASTM Standards*, Vol 03.06.

⁵ *Annual Book of ASTM Standards*, Vol 13.01.

⁶ Available from Society of Automotive Engineers, Inc., 400 Commonwealth Dr., Warrendale, PA 15096-0001.

⁷ Available from American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY, 10036.

⁸ Available from American Society for Quality, 600 N. Plankinton Ave., Milwaukee, WI 53203.

⁹ Available from Standardization Documents Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, Attn: NPODS.