



Designation: B363 – 23

# Standard Specification for Seamless and Welded Unalloyed Titanium and Titanium Alloy Welding Fittings<sup>1</sup>

This standard is issued under the fixed designation B363; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope\*

1.1 This specification<sup>2</sup> covers fittings intended for general corrosion-resisting and elevated-temperature services, factory made from unalloyed titanium and titanium alloys. The term welding fittings applies to parts such as 45° and 90° elbows, 180° returns, caps, tees, reducers, lap-joint stub ends, and other types.

1.2 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.3 *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:*<sup>3</sup> <https://www.astm.org/catalog/standards/sist/bd0aa5f4-d768>

[B265 Specification for Titanium and Titanium Alloy Strip, Sheet, and Plate](#)

[B338 Specification for Seamless and Welded Titanium and Titanium Alloy Tubes for Condensers and Heat Exchangers](#)

[B348 Specification for Titanium and Titanium Alloy Bars and Billets](#)

[B367 Specification for Titanium and Titanium Alloy Castings](#)

[B381 Specification for Titanium and Titanium Alloy Forgings](#)

[B600 Guide for Descaling and Cleaning Titanium and Titanium Alloy Surfaces](#)

[B861 Specification for Titanium and Titanium Alloy Seamless Pipe](#)

[B862 Specification for Titanium and Titanium Alloy Welded Pipe](#)

2.2 *ANSI Standards:*<sup>4,5</sup>

[ASME/ANSI B16.5 Pipe Flanges and Flanged Fittings](#)

[ASME/ANSI B16.9 Factory-Made Wrought Steel Butt-Welding Fittings](#)

[ASME/ANSI B16.11 Forged Fittings, Socket Welding and Threaded](#)

[ASME/ANSI B36.19 Stainless Steel Pipe](#)

2.3 *Manufacturers' Standardization Society of the Valve and Fittings Industry Standards:*<sup>6</sup>

[MSS SP-25 Standard Marking System for Valves, Fittings, Flanges and Unions](#)

[MSS SP-43 Standard Practice for Wrought and Fabricated Butt-Welded Fittings for Low Pressure, Corrosion Resistant Applications](#)

[MSS SP-97 Standard Integrally Reinforced Forged Branch Outlet Fittings — Socket Welding, Threaded, and Butt-Welding Ends](#)

[MSS SP-119 Standard Factory-Made Wrought Belled End Socket-Welding Fittings for Socket Welding](#)

2.4 *ASME Standard:*<sup>7</sup>

[ASME Boiler and Pressure Vessel Code Sections VIII Division 1 Pressure Vessels and Section IX](#)

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee B10 on Reactive and Refractory Metals and Alloys and is the direct responsibility of Subcommittee B10.01 on Titanium.

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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications, see related Specification SB-363 in Section II of that Code.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>4</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>5</sup> Specifications in the order are for "dimensions only" with no requirements for strength or pressure rating to be inferred. (that is, Class XXXX is not intended to designate a strength or pressure rating requirement for titanium; only to define a dimension for that category.)

<sup>6</sup> Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, <http://www.msshq.com>.

<sup>7</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

\*A Summary of Changes section appears at the end of this standard

3. Ordering Information

3.1 Orders for material to this specification shall include the following information as required:

- 3.1.1 Quantity,
- 3.1.2 Grade number,
- 3.1.3 Pipe size and schedule,
- 3.1.4 Method of manufacture and finish,
- 3.1.5 Restrictive chemistry, if desired,
- 3.1.6 Nondestructive tests,
- 3.1.7 Packaging,
- 3.1.8 Inspection and required reports,
- 3.1.9 Appropriate fittings specifications for dimensions only, and
- 3.1.10 Class, as required.

4. Material

4.1 The titanium for welding fittings may consist of billets, bars, plates, castings, seamless or welded pipe or tube that conforms to all the requirements for manufacturing process, testing, chemical composition, and mechanical properties prescribed in Specifications B861 and B862 for the particular grades referred to in Table 1.

5. Manufacture

5.1 Forging, forming, or shaping operations may be performed by hammering, pressing, piercing, extruding, upsetting, rolling, bending, fusion welding, or by a combination of two or

TABLE 2 Permissible Variations in Product Analysis

Element	Product Analysis Limits, max or Range, %	Permissible Variation in Product Analysis
Aluminum	0.5 to 2.5	±0.20
Aluminum	2.5 to 6.75	±0.40
Carbon	0.10	+0.02
Chromium	0.1 to 0.2	±0.02
Chromium	5.5 to 6.5	±0.30
Hydrogen	0.02	+0.002
Iron	0.80	+0.15
Iron	0.80 to 1.8	±0.20
Molybdenum	0.2 to 0.4	±0.03
Molybdenum	1.5 to 4.5	±0.20
Molybdenum	14.0 to 16.0	±0.50
Nickel	0.3 to 0.9	±0.05
Niobium	2.2 to 3.2	±0.15
Niobium	>30	±0.50
Nitrogen	0.05	+0.02
Oxygen	0.30	+0.03
Oxygen	0.31 to 0.40	±0.04
Palladium	0.01 to 0.02	±0.002
Palladium	0.04 to 0.08	±0.005
Palladium	0.12 to 0.25	±0.02
Ruthenium	0.02 to 0.04	±0.005
Ruthenium	0.04 to 0.06	±0.005
Ruthenium	0.08 to 0.14	±0.01
Silicon	0.06 to 0.40	±0.02
Vanadium	1.1 to 4.5	±0.15
Vanadium	7.5 to 8.5	±0.40
Zirconium	3.5 to 4.5	±0.20
Residuals <sup>A</sup> (each)	0.15	+0.02

<sup>A</sup> A residual is an element present in a metal or alloy in small quantities and is inherent to the manufacturing process but not added intentionally. In titanium these elements include aluminum, vanadium, tin, iron, chromium, molybdenum, niobium, zirconium, hafnium, bismuth, ruthenium, palladium, yttrium, copper, silicon, cobalt, tantalum, nickel, boron, manganese, and tungsten.

TABLE 1 Permissible Raw Materials

Grade <sup>A</sup>	Product and ASTM Designation						
	Pipe	Tube	Plate	Bar and Billet	Casting	Forging	
WPT1	B861/B862 Grade 1	B338 Grade 1	B265 Grade 1	B348 Grade 1	B367 Grade C1	B381 Grade F-1	
WPT2	B861/B862 Grade 2	B338 Grade 2	B265 Grade 2	B348 Grade 2	B367 Grade C2	B381 Grade F-2	
WPT2H	B861/B862 Grade 2H	B338 Grade 2H	B265 Grade 2H	B348 Grade 2H	...	B381 Grade F-2H	
WPT3	B861/B862 Grade 3	B338 Grade 3	B265 Grade 3	B348 Grade 3	B367 Grade C3	B381 Grade F-3	
WPT7	B861/B862 Grade 7	B338 Grade 7	B265 Grade 7	B348 Grade 7	B367 Grade C7	B381 Grade F-7	
WPT7H	B861/B862 Grade 7H	B338 Grade 7H	B265 Grade 7H	B348 Grade 7H	...	B381 Grade F-7H	
WPT9	B861/B862 Grade 9	B338 Grade 9	B265 Grade 9	B348 Grade 9	B367 Grade C9	B381 Grade F-9	
WPT11	B861/B862 Grade 11	B338 Grade 11	B265 Grade 11	B348 Grade 11	...	B381 Grade F-11	
WPT12	B861/B862 Grade 12	B338 Grade 12	B265 Grade 12	B348 Grade 12	B367 Grade C12	B381 Grade F-12	
WPT13	B861/B862 Grade 13	B338 Grade 13	B265 Grade 13	B348 Grade 13	...	B381 Grade F-13	
WPT14	B861/B862 Grade 14	B338 Grade 14	B265 Grade 14	B348 Grade 14	...	B381 Grade F-14	
WPT15	B861/B862 Grade 15	B338 Grade 15	B265 Grade 15	B348 Grade 15	...	B381 Grade F-15	
WPT16	B861/B862 Grade 16	B338 Grade 16	B265 Grade 16	B348 Grade 16	B367 Grade C16	B381 Grade F-16	
WPT16H	B861/B862 Grade 16H	B338 Grade 16H	B265 Grade 16H	B348 Grade 16H	...	B381 Grade F-16H	
WPT17	B861/B862 Grade 17	B338 Grade 17	B265 Grade 17	B348 Grade 17	B367 Grade C17	B381 Grade F-17	
WPT18	B861/B862 Grade 18	B338 Grade 18	B265 Grade 18	B348 Grade 18	B367 Grade C18	B381 Grade F-18	
WPT19	B861/B862 Grade 19	...	B265 Grade 19	B348 Grade 19	...	B381 Grade F-19	
WPT20	B861/B862 Grade 20	...	B265 Grade 20	B348 Grade 20	...	B381 Grade F-20	
WPT21	B861/B862 Grade 21	...	B265 Grade 21	B348 Grade 21	...	B381 Grade F-21	
WPT23	B861/B862 Grade 23	...	B265 Grade 23	B348 Grade 23	...	B381 Grade F-23	
WPT24	B861/B862 Grade 24	...	B265 Grade 24	B348 Grade 24	...	B381 Grade F-24	
WPT25	B861/B862 Grade 25	...	B265 Grade 25	B348 Grade 25	...	B381 Grade F-25	
WPT26	B861/B862 Grade 26	B338 Grade 26	B265 Grade 26	B348 Grade 26	...	B381 Grade F-26	
WPT26H	B861/B862 Grade 26H	B338 Grade 26H	B265 Grade 26H	B348 Grade 26H	...	B381 Grade F-26H	
WPT27	B861/B862 Grade 27	B338 Grade 27	B265 Grade 27	B348 Grade 27	...	B381 Grade F-27	
WPT28	B861/B862 Grade 28	B338 Grade 28	B265 Grade 28	B348 Grade 28	...	B381 Grade F-28	
WPT33	B861/B862 Grade 33	B338 Grade 33	B265 Grade 33	B348 Grade 33	...	B381 Grade F-33	
WPT34	B861/B862 Grade 34	B338 Grade 34	B265 Grade 34	B348 Grade 34	...	B381 Grade F-34	
WPT35	B861/B862 Grade 35	B338 Grade 35	B265 Grade 35	B348 Grade 35	...	B381 Grade F-35	
WPT36	B861/B862 Grade 36	B338 Grade 36	B265 Grade 36	B348 Grade 36	...	B381 Grade F-36	
WPT37	B861/B862 Grade 37	B338 Grade 37	B265 Grade 37	B348 Grade 37	...	B381 Grade F-37	
WPT38	B861/B862 Grade 38	B338 Grade 38	B265 Grade 38	B348 Grade 38	B367 Grade C38	B381 Grade F-38	

<sup>A</sup> When fittings are of welded construction, the symbol shown shall be supplemented by the letter "W."