SPECIFICATION FOR SEAMLESS AND WELDED UNALLOYED TITANIUM AND TITANIUM ALLOY WELDING FITTINGS

SB-363

(Identical with ASTM Specification B363-06a except for section 11.3, which requires mandatory certification.)

All fittings welded with filler metal intended for applications under the rules of Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code shall conform to the following: Manufacturer of such products are limited to manufacturers holding the appropriate ASME Certificate of Authorization and Certification Mark. In addition to conforming to this specification, the manufacturer shall meet all applicable requirements of Section VIII, Division 1 of the Code. The materials used to fabricate the fitting shall conform to ASME SB Specifications. The product shall be subject to all applicable requirements of Section VIII, Division 1 of the Code including welding, heat treatment, nondestructive examination, authorized inspection at the point of manufacture, and application of the Certification Mark. The applicable ASME Partial Data Report Form signed by an Authorized Inspector and a certified mill test report shall be furnished for each lot of fittings. The term "lot" applies to all fittings of the same mill heat of material, size, and wall thickness, which are heat-treated, if applicable in one furnace charge. Each fitting shall be marked in such a manner to identify each such piece with the "lot" and the certified mill test report.

SPECIFICATION FOR SEAMLESS AND WELDED UNALLOYED TITANIUM AND TITANIUM ALLOY WELDING FITTINGS

SB-363

(Identical with ASTM Specification B 363-06a for all grades except for section 11.3, which requires mandatory certification.

All fittings welded with filler metal intended for applications under the rules of Section VIII, Div. 1 of the ASME Boiler and Pressure Vessel Code shall conform to the following: Manufacturer of such products are limited to manufacturers holding the appropriate ASME Certificate of Authorization and Certification Mark. In addition to conforming to this specification, the manufacturer shall meet all applicable requirements of Section VIII, Div. 1 of the Code. The materials used to fabricate the fitting shall conform to ASME SB Specifications. The product shall be subject to all applicable requirements of Section VIII, Div. 1 of the Code including welding, heat treatment, nondestructive examination, authorized inspection at the point of manufacture, and application of the Certification Mark. The applicable ASME Partial Data Report Form signed by an Authorized Inspector and a certified mill test report shall be furnished for each lot of fittings. The term "lot" applies to all fittings of the same mill heat of material, size, and wall thickness, which are heat-treated, if applicable in one furnace charge. Each fitting shall be marked in such a manner to identify each such piece with the "lot" and the certified mill test report.)

1. Scope

1.1 This specification 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 butt-welding 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

B 265 Specification for Titanium and Titanium Alloy Strip, Sheet, and Plate
B 338 Specification for Seamless and Welded Titanium and Titanium Alloy Tubes for Condensers and Heat Exchangers
B 348 Specification for Titanium and Titanium Alloy Bars and Billets
B 367 Specification for Titanium and Titanium Alloy Castings
B 381 Specification for Titanium and Titanium Alloy Forgings
B 600 Guide for Descaling and Cleaning Titanium and Titanium Alloy Surfaces
B 861 Specification for Titanium and Titanium Alloy Seamless Pipe
B 862 Specification for Titanium and Titanium Alloy Welded Pipe

2.2 *ANSI Standards:*

B16.9 Wrought Steel Butt-Welding Fittings
B36.19 Stainless Steel Pipe

2.3 *Manufacturers' Standardization Society of the Valve and Fittings Industry Standards:*

SP-25 Standard Marking System for Valves, Fittings, Flanges and Unions
SP-43 Standard Practice for Light Weight Stainless Steel Butt-Welding Fittings

TABLE 1
PERMISSIBLE RAW MATERIALS

Grade (A)	Product and ASTM Designation					
	Pipe	Tube	Plate	Bar and Billet	Casting	Forging
WPT1	B 861/B 862 Grade 1	B 338 Grade 1	B 265 Grade 1	B 348 Grade 1	B 367 Grade C1	B 381 Grade F-1
WPT2	B 861/B 862 Grade 2	B 338 Grade 2	B 265 Grade 2	B 348 Grade 2	B 367 Grade C2	B 381 Grade F-2
WPT2H	B 861/B 862 Grade 2H	B 338 Grade 2H	B 265 Grade 2H	B 348 Grade 2H	B 367 Grade C2	B 381 Grade F-2H
WPT3	B 861/B 862 Grade 3	B 338 Grade 3	B 265 Grade 3	B 348 Grade 3	B 367 Grade C3	B 381 Grade F-3
WPT7	B 861/B 862 Grade 7	B 338 Grade 7	B 265 Grade 7	B 348 Grade 7	B 367 Grade C7	B 381 Grade F-7
WPT7H	B 861/B 862 Grade 7H	B 338 Grade 7H	B 265 Grade 7H	B 348 Grade 7H	B 367 Grade C7	B 381 Grade F-7H
WPT9	B 861/B 862 Grade 9	B 338 Grade 9	B 265 Grade 9	B 348 Grade 9	...	B 381 Grade F-9
WPT11	B 861/B 862 Grade 11	B 338 Grade 11	B 265 Grade 11	B 348 Grade 11	B 367 Grade C11	B 381 Grade F-11
WPT12	B 861/B 862 Grade 12	B 338 Grade 12	B 265 Grade 12	B 348 Grade 12	...	B 381 Grade F-12
WPT13	B 861/B 862 Grade 13	B 338 Grade 13	B 265 Grade 13	B 348 Grade 13	...	B 381 Grade F-13
WPT14	B 861/B 862 Grade 14	B 338 Grade 14	B 265 Grade 14	B 348 Grade 14	...	B 381 Grade F-14
WPT15	B 861/B 862 Grade 15	B 338 Grade 15	B 265 Grade 15	B 348 Grade 15	...	B 381 Grade F-15
WPT16	B 861/B 862 Grade 16	B 338 Grade 16	B 265 Grade 16	B 348 Grade 16	...	B 381 Grade F-16
WPT16H	B 861/B 862 Grade 16H	B 338 Grade 16H	B 265 Grade 16H	B 348 Grade 16H	...	B 381 Grade F-16H
WPT17	B 861/B 862 Grade 17	B 338 Grade 17	B 265 Grade 17	B 348 Grade 17	...	B 381 Grade F-17
WPT18	B 861/B 862 Grade 18	B 338 Grade 18	B 265 Grade 18	B 348 Grade 18	...	B 381 Grade F-18
WPT19	B 861/B 862 Grade 19	...	B 265 Grade 19	B 348 Grade 19	...	B 381 Grade F-19
WPT20	B 861/B 862 Grade 20	...	B 265 Grade 20	B 348 Grade 20	...	B 381 Grade F-20
WPT21	B 861/B 862 Grade 21	...	B 265 Grade 21	B 348 Grade 21	...	B 381 Grade F-21
WPT23	B 861/B 862 Grade 23	...	B 265 Grade 23	B 348 Grade 23	...	B 381 Grade F-23
WPT24	B 861/B 862 Grade 24	...	B 265 Grade 24	B 348 Grade 24	...	B 381 Grade F-24
WPT25	B 861/B 862 Grade 25	...	B 265 Grade 25	B 348 Grade 25	...	B 381 Grade F-25
WPT26	B 861/B 862 Grade 26	B 338 Grade 26	B 265 Grade 26	B 348 Grade 26	...	B 381 Grade F-26
WPT26H	B 861/B 862 Grade 26H	B 338 Grade 26H	B 265 Grade 26H	B 348 Grade 26H	...	B 381 Grade F-26H
WPT27	B 861/B 862 Grade 27	B 338 Grade 27	B 265 Grade 27	B 348 Grade 27	...	B 381 Grade F-27
WPT28	B 861/B 862 Grade 28	B 338 Grade 28	B 265 Grade 28	B 348 Grade 28	...	B 381 Grade F-28
WPT33	B 861/B 862 Grade 33	B 338 Grade 33	B 265 Grade 33	B 348 Grade 33	...	B 381 Grade F-33
WPT34	B 861/B 862 Grade 34	B 338 Grade 34	B 265 Grade 34	B 348 Grade 34	...	B 381 Grade F-34
WPT35	B 861/B 862 Grade 35	B 338 Grade 35	B 265 Grade 35	B 348 Grade 35	...	B 381 Grade F-35
WPT36	B 861/B 862 Grade 36	B 338 Grade 36	B 265 Grade 36	B 348 Grade 36	...	B 381 Grade F-36
WPT37	B 861/B 862 Grade 37	B 338 Grade 37	B 265 Grade 37	B 348 Grade 37	...	B 381 Grade F-37
WPT38	B 861/B 862 Grade 38	B 338 Grade 38	B 265 Grade 38	B 348 Grade 38	...	B 381 Grade F-38

NOTE:
(A) When fittings are of welded construction, the symbol shown shall be supplemented by the letter "W."

2.4 *ASME Standard:*

ASME Boiler and Pressure Vessel Code, Sections VIII and IX

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, and

3.1.8 Inspection and required reports,

3.1.9 Certification requirements.

4. Material

4.1 The titanium for welding fittings may consist of billets, bars, plates, seamless or welded pipe or tube that conforms to all the requirements for manufacturing process, testing, chemical composition, and mechanical properties prescribed in Specifications B 861 and B 862 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 more of these operations. The forming

procedure shall be so applied that it will not produce injurious defects in the fittings.

5.2 Fittings containing welded seams or other joints made by fusion welding shall comply with the following provision:

5.2.1 Welded by welders, welding operators, and welding procedures qualified under the provisions of Section IX of the ASME Boiler and Pressure Vessel Code.

NOTE 1: Annealing of the unalloyed and alloyed grades of titanium covered by this specification is for the purpose of assuring uniform properties.

6. Chemical Composition

6.1 The titanium shall conform to the requirements as to chemical composition prescribed in the specifications referred to in Table 1.

6.2 The chemical analysis of the components of the fittings need not be reported unless required by agreement between the manufacturer and the purchaser and so specified on the order.

7. Product Analysis

7.1 Product analysis may be made by the purchaser from one or more fittings in each lot.

NOTE 2: Definition of the term "lot" shall be as agreed upon between the manufacturer and the purchaser.

7.2 Product analysis tolerances do not broaden the specified heat analysis requirements, but cover variations between different laboratories in the measurement of chemical content. The manufacturer shall not ship material that is outside the limits specified for the applicable grade. Product analysis tolerances shall be as specified in Table 2.

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	1.2 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	2.0 to 4.5	±0.15
Vanadium	7.5 to 8.5	±0.40
Zirconium	3.5 to 4.5	±0.20
Residuals (A) (each)	0.15	+0.02

Note:
(A) 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.
† Niobium value added editorially.

8. Tensile Properties

8.1 The titanium shall conform to the requirements as to tensile properties prescribed in the specifications referred to in Table 1.

8.2 Tensile tests of the finished fittings need not be reported unless required by agreement between the manufacturer and the purchaser and so stated in the order.

9. Workmanship, Finish and Appearance

9.1 For fittings covered by ANSI B16.9 or SP-43, or for fittings to be used with pipe ordered to ANSI B36.19, the sizes, shapes, and dimensions of the fittings shall be as specified in those standards.

9.2 The fittings shall have a workmanlike finish and shall be free of injurious external and internal imperfections of a nature that will interfere with the purpose for which the fittings are intended. Minor defects may be removed by grinding, providing the wall thickness is not decreased to less than the minimum thickness, and further provided that the ground-out area shall be faired out.

10. Hydrostatic Tests

10.1 All fittings shall be capable of withstanding without failure, leakage, or impairment of their serviceability, a test pressure prescribed in the specifications for the pipe or tubing with which the fitting is recommended to be used (see Table 1).

10.2 Hydrostatic tests need not be performed or reported, unless required by agreement between the manufacturer and the purchaser and so stated on the order.

11. Inspection and Certification

11.1 Inspection by the purchaser prior to shipment shall be specified in the purchase order.

11.2 The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the fittings are being furnished in accordance with this specification. Any tests (except product analysis) and inspection agreed upon and so stated in the purchase order shall be made at the place of manufacture, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

11.3 *Certification*—The manufacturer shall furnish the purchaser a certificate that the finished fittings conform to the requirements of this specification.

NOTE 3: It is recognized that a sensitive surface inspection of the welds or base metal, or both, is advisable for some services. See Supplementary Requirements.

12. Rejection

12.1 Material not conforming to this specification or to authorized modifications shall be subject to rejection. Unless otherwise specified, rejected material may be returned to the manufacturer at the manufacturer's expense, unless the purchaser receives, within 3 weeks of notice of rejection, other instructions for disposition.

13. Product Marking

13.1 The manufacturer's name or trademark, the schedule number, material, and size shall be stamped (Note 4), stenciled, electroetched, or otherwise suitably marked on each fitting. In addition, each fitting shall be marked with the identification symbol and suffix for the respective specification listed in Table 1. On wall thicknesses thinner than Schedule 40S, no stamps or other indented markings shall be used. When the size does not permit complete marking, identification marks may be omitted in the sequence shown in SP-25.

NOTE 4: When steel stamps are used, they should be applied prior to heat treatment and care should be taken so that the marking is not deep enough to cause cracks or to reduce the wall thickness of the fitting below the minimum allowed.

14. Keywords

14.1 fittings; seamless fittings; titanium; titanium alloy; welded fittings

SUPPLEMENTARY REQUIREMENTS

Supplementary requirements shall not be considered unless specified in the order, in which event the test shall be made by the manufacturer at the purchaser's expense.

S1. Surface Inspection

S1.1 Liquid penetrant inspection may be performed on all outside-diameter surfaces of the fittings and inside-diameter surfaces where practicable. An acceptance standard may be agreed upon between the manufacturer and the purchaser prior to the acceptance of the order.

S2. Radiographic Inspections of Welds

S2.1 Radiographic inspection may be performed on all weldments of the fittings in accordance with paragraph UW-51, Section VIII of the ASME Boiler and Pressure Vessel Code.

S3. Stress Relief Heat Treatment

S3.1 The stress-relieving treatment shall consist of holding the fitting at a minimum temperature of 1100°F for not less than ½ h/in. of thickness.

S3.2 Minimum time at temperature is 15 min. All parts stress relieved shall be subsequently cleaned and free of oxide scale contamination (see Guide B 600).

S4. Certification of Material Incorporated in the Manufacture of the Fittings

S4.1 All material incorporated within the fitting shall be documented and shall be in accordance with the applicable documents in Table 1.