



## Standard Specification for Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings<sup>1</sup>

This standard is issued under the fixed designation A 815/A 815M; 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.

### 1. Scope

1.1 This specification covers two general classes, WP and CR, of wrought ferritic, ferritic/austenitic, and martensitic stainless steel fittings of seamless and welded construction covered by the latest revision of ANSI B16.9, ANSI B16.11, ANSI B16.28, MSS Standard Practice SP-79, and MSS Standard Practice SP-43. Fittings differing from these standards may be furnished in accordance with Supplementary Requirement S8.

1.1.1 Class WP fittings are subdivided into four subclasses: Classes WP-S, WP-W, WP-WX, and WP-WU. They are manufactured to the requirements of ANSI B16.9, B16.11, B16.28, or MSS Standard Practice SP-79, and they shall have pressure ratings compatible with 12.2. Class WP-S fittings are those manufactured from seamless product by a seamless method of manufacture (marked with class symbol WP-S); Class WP-W fittings are those which contain welds where the fitting fabrication or construction welds have been radiographed (marked with class symbol WP-W); and Class WP-WX fittings are those which contain welds where all welds have been radiographed (marked with class symbol WP-WX); and Class WP-WU fittings are those which contain welds where all welds have been ultrasonically tested (marked with class symbol WP-WU).

1.1.2 Class CR fittings are those manufactured to the requirements of MSS SP-43, and they shall have pressure ratings compatible with 12.3.

1.2 This specification does not apply to cast fittings.

1.3 Optional supplementary requirements are provided. When desired, one or more of these may be specified in the order.

1.4 This specification is expressed in both inch-pound units and in SI units. However, unless the order specifies the applicable “M” specification designation [SI units], the material shall be furnished to inch-pound units.

1.5 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each

system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels<sup>2</sup>

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products<sup>2</sup>

A 388/A388M Practice for Ultrasonic Examination of Heavy Steel Forgings<sup>3</sup>

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products<sup>2</sup>

A 763 Practices for Detecting Susceptibility to Intergranular Attack in Ferritic Stainless Steels<sup>2</sup>

E 165 Test Method for Liquid Penetrant Examination<sup>4</sup>

#### 2.2 ASME Standards:<sup>5</sup>

B16.9 Wrought Steel Butt-Welding Fittings

B16.11 Forged Steel Fittings, Socket-Welding and Threaded

B16.28 Wrought Steel Butt-Welding Short Radius Elbows and Returns

#### 2.3 MSS Standards:<sup>6</sup>

SP-25 Standard Marking System for Valves, Fittings, Flanges, and Unions

SP-43 Standard Practice for Light Weight Stainless Steel Butt-Welding Fittings

SP-79 Socket-Welding Reducer Inserts

#### 2.4 ASME Boiler and Pressure Vessel Codes:<sup>5</sup>

Section VIII Division I, Pressure Vessels

Section IX Welding Qualifications

#### 2.5 ASNT Standard:<sup>7</sup>

SNT-TC-1A(1984) Recommended Practice for Nondestructive Testing Personnel Qualification and Certification

<sup>2</sup> Annual Book of ASTM Standards, Vol 01.03.

<sup>3</sup> Annual Book of ASTM Standards, Vol 01.05.

<sup>4</sup> Annual Book of ASTM Standards, Vol 03.03.

<sup>5</sup> Available from American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5900.

<sup>6</sup> Available from Manufacturers' Standardization Society of the Valve and Fittings Industry, 127 Park St., N.E., Vienna, VA 22180.

<sup>7</sup> Available from American Society for Nondestructive Testing, 4153 Arlingdale Plaza, P.O. Box 28518, Columbus, OH 43228-0518.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.22 on Steel Forgings and Wrought Fittings for Piping Applications and Bolting Materials for Piping and Special Purpose Applications.

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**3. Ordering Information**

3.1 It is the purchaser's responsibility to specify in the purchase order all ordering information necessary needed to purchase the needed material. Examples of such information include but are not limited to the following:

- 3.1.1 Quantity, number of fittings of each kind,
- 3.1.2 Description of fitting and nominal dimension (standard or special),
- 3.1.3 Steel composition by grade and Class designation,
- 3.1.4 Class WP or CR shall be specified. Class WP fittings may be further defined by specifying Class WP-S, WP-W, or WP-WX,
- 3.1.4.1 Unless Class WP-S, WP-W, or WP-WX is specified by the purchaser, any may be furnished at the option of the supplier,
- 3.1.4.2 Class CR fittings shall not be substituted for fittings ordered to Class WP, but Class WP may be substituted for Class CR, and
- 3.1.5 Supplementary requirements, if any.
- 3.1.6 Additional requirements (see 4.1, 13.2, and 16.1).

**4. Materials**

- 4.1 The material for fittings shall consist of forgings, bars, plates, or seamless or welded tubular products that conform to the chemical requirements in Table 1.
- 4.2 The steel shall be melted by one of the following processes:
  - 4.2.1 Electric furnace (with separate degassing and refining optional),
  - 4.2.2 Vacuum furnace, or
  - 4.2.3 Electric furnace followed by vacuum or electroslag-consumable remelting.
- 4.3 If secondary melting is employed, the heat shall be defined as all ingots remelted from a primary heat.

**5. Manufacture**

5.1 *Forming*—Forging or shaping operations may be performed by hammering, pressing, piercing, extruding, upsetting, rolling, bending, fusion welding, machining or by combination of two or more of these operations. The forming procedure

**TABLE 1 Chemical Requirements**

NOTE 1—Where an ellipsis ( . . . ) appears in this table, there is no requirement.

Grade	UNS	Composition, %											
		C, max	Mn, max	P, max	S, max	Si, max	Ni <sup>A</sup>	Cr	Mo	Cu, max	N	Ti	Other
Ferritic Steels													
WP27	S44627	0.010	0.75	0.020	0.020	0.40	0.50	25.0–27.5	0.75–1.50	0.20	0.015 max	...	Cb 0.05–0.20
WP33	S44626	0.06	0.75	0.040	0.020	0.75	0.50	25.0–27.0	0.75–1.50	0.20	0.040 max	0.20–1.00 (7×(C+N)) min	...
WP429	S42900	0.12	1.0	0.040	0.030	0.75	0.50	14.0–16.0	...	...	...	...	...
WP430	S43000	0.12	1.00	0.040	0.030	1.00	0.50	16.0–18.0	...	...	...	...	...
WP430TI	S43036	0.10	1.00	0.040	0.030	1.00	0.75	16.0–19.5	...	...	...	(5×C) min max	0.75
WP446	S44600	0.20	1.50	0.040	0.030	0.75	0.50	23.0–27.0	...	...	0.25	...	...
Ferritic/Austenitic Steels													
S31803	S31803	0.030	2.00	0.030	0.020	1.0	4.5–6.5	21.0–23.0	2.5–3.5	...	0.08–0.20	...	...
S32750	S32750	0.030	1.20	0.035	0.020	0.8	6.0–8.0	24.0–26.0	3.0–5.0	0.5	0.24–0.32	...	...
S32950	S32950	0.030	2.00	0.035	0.010	0.60	3.5–5.2	26.0–29.0	1.00–2.50	...	0.15–0.35	...	...
S32760	S32760	0.030	1.00	0.030	0.010	1.00	6.0–8.0	24.0–26.0 <sup>B</sup>	3.0–4.0 <sup>B</sup>	0.50–1.00	0.20–0.30 <sup>B</sup>	...	W 0.50–1.00
S39274	S32974	0.030	1.00	0.030	0.020	0.80	6.0–8.0	24.0–26.0	2.50–3.50 <sup>B</sup>	0.20–0.80	0.24–0.32	...	W 1.50–2.50
S32550	S32550	0.04	1.50	0.040	0.030	1.00	4.5–6.5	24.0–27.0	2.9–3.9	1.50–2.50	0.10–0.25	...	...
S32205	S32205	0.030	2.00	0.030	0.020	1.00	4.5–6.5	22.0–23.0	3.0–3.5	...	0.14–0.20	...	...
Martensitic Steels													
WP410	S41000	0.15	1.00	0.040	0.030	1.00	0.50 max	11.5–13.5	...	...	...	...	...
UNS S41500	S41500	0.05	0.50–1.00	0.030	0.030	0.60	3.5–5.5	11.5–14.0	0.50–1.00	...	...	...	W 0.50–1.00

<sup>A</sup> Maximum unless otherwise indicated.  
<sup>B</sup> % Cr + 3.3 × % Mo + 16 × % N = 40 min.

shall be so applied that it will not produce surface discontinuities deeper than 5 % of the specified nominal thickness of the fitting.

5.2 All classes of fittings shall be heat treated in accordance with Section 6.

5.3 Fittings ordered as Class WP-S shall be of seamless construction and shall meet all requirements of ANSI B16.9, B16.11, B16.28, or MSS SP-79.

5.4 Fittings ordered as Class WP-W shall meet the requirements of ANSI B16.9 or B16.28 and (1) shall have all welds made by the fitting manufacturer and all pipe welds made with the addition of filler metal radiographically examined throughout the entire length in accordance with Paragraph UW-51 of Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code; and (2) shall not require radiography of the starting pipe weld if the pipe was welded without the addition of filler metal. In place of radiographic examination, welds made by the fitting manufacturer may be ultrasonically examined in accordance with the code requirements stated in 5.6.

5.5 Fittings ordered as Class WP-WX shall meet the requirements of ANSI B16.9 or B16.28 and shall have all welds, whether made by the fitting manufacturer or the starting material manufacturer, radiographically examined throughout their entire length in accordance with Paragraph UW-51 of Section VIII, Division I of the ASME Boiler and Pressure Vessel Code. The radiography of welds for this class of fittings can be done either prior to or after forming at the option of the manufacturer.

5.6 Fittings ordered as Class WP-WU shall meet the requirements of ANSI B16.9 or B16.28 and shall have all welds, whether made by the fitting manufacturer or the starting material manufacturer, ultrasonically examined throughout their entire length in accordance with Appendix 12 of Section VIII, Division 1 of ASME Boiler and Pressure Vessel Code.

5.7 The radiography or ultrasonic examination for this class of fittings may be done at the option of the manufacturer, either prior to or after forming.

5.8 Personnel performing NDE examinations shall be qualified in accordance with SNT-TC-1A.

5.9 Fittings covered in MSS SP-43 and ordered as CR shall meet the requirements of MSS SP-43 and do not require nondestructive examination.

5.10 All classes of fittings shall have the welders, welding operators, and welded procedures qualified under the provisions of Section IX of the ASME Boiler and Pressure Vessel Code except that starting pipe welds made without the addition of filler metal do not require such qualification.

5.11 All joints welded with filler metal shall be finished in accordance with the requirements of Paragraph UW-35 (a) of Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code.

5.12 Fittings machined from bar shall be restricted to NPS 4 or smaller.

5.12.1 All caps machined from bar shall be examined by liquid penetrant in accordance with Practice E 165.

5.13 Weld buildup is permitted to dimensionally correct unfilled areas produced during cold forming of stub ends. Radiographic examination of the weld buildup shall not be

required provided that all of the following steps are adhered to:

5.13.1 The weld procedure and welders or welding operators meet the requirements of 5.10,

5.13.2 Heat-treatment is performed after welding and prior to machining,

5.13.3 All weld surfaces are liquid penetrant examined in accordance with Appendix 8 of Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code, and

5.13.4 Repair of areas in the weld is permitted, but 5.13.1, 5.13.2, and 5.13.3 must be repeated.

5.13.5 Fittings shall be marked with the symbol WBU following the alloy designation and classification (for example, WP430/WBU, WPS31803/WPU, WP410/WBU, etc.).

5.14 Stub ends may be produced with the entire lap added as weld metal to a straight pipe section provided the welding satisfies the requirements of 5.8 for qualifications and 6.4 for post weld heat treatment.

5.14.1 *Class WP-W*—Radiographic inspection of the weld is required (see 5.4).

5.14.2 *Class WP-WX*—Radiographic inspection of all welds is required (see 5.5).

5.14.3 *Class WP-WU*—Ultrasonic inspection of all welds is required (see 5.6).

5.14.4 *Class CR*—Nondestructive examination is not required (see 5.9).

5.15 Stubends may be produced with the entire lap added by the welding of a ring, made from plate or bar of the same alloy grade and composition, to the outside of a straight section of pipe, provided the weld is double welded, is a full penetration joint, satisfies the requirements of 5.10 for qualifications and 6.4 for post weld heat treatment.

5.15.1 *Class WP-W*—Radiographic inspection of all welds, made with the addition of filler metal is required (see 5.4).

5.15.2 *Class WP-WX*—Radiographic inspection of all welds, made with or without the addition of filler metal, is required (see 5.5).

5.15.3 *Class WP-WU*—Ultrasonic inspection of all welds, made with or without the addition of filler metal, is required (see 5.6).

5.15.4 *Class CR*—Nondestructive examination is not required (see 5.9).

## 6. Heat Treatment

6.1 *Ferritic Grades*—As a final heat treatment, the ferritic fittings shall be reheated to a temperature of 1200°F [650°C] or higher, and cooled (as appropriate for the grade) to meet the requirements of this specification.

### 6.2 *Ferritic/Austenitic:*

6.2.1 As a final heat treatment, the ferritic/austenitic grade UNS S31803, shall be reheated to a temperature of 1870° to 2010°F [1020° to 1100°C], with subsequent quenching in water or rapidly cooling by other means.

6.2.2 As a final heat treatment, the ferritic-austenitic grade INS 32205, shall be reheated to a temperature of 1870 to 2010°F [1020 to 1100°C], with subsequent quenching in water.

6.2.3 As a final heat treatment, the ferritic/austenitic grade UNS S32750, shall be reheated to a temperature of 1920 to 2060°F [1025 to 1125°C], with subsequent quenching in water or rapidly cooling by other means.