



Standard Specification for Factory-Made Wrought Nickel and Nickel Alloy Fittings¹

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1. Scope

1.1 This specification covers wrought welding fittings for pressure piping, factory-made from nickel and nickel alloys. Threaded fittings as covered in ASME B16.11 are also covered by this specification. The term welding applies to butt-welding or socket-welding parts such as 45 and 90° elbows, 180° bends, caps, tees, reducers, lap-joint stub ends, and other types, as covered by ASME B16.9, ASME B16.11, ASME B16.28, MSS SP-43, MSS SP-95, and MSS SP-97.

1.1.1 Class WP fittings are those manufactured to the requirements of ASME B16.9, B16.11, or B16.28.

1.1.2 Class CR fittings are those manufactured to the requirements of MSS SP-43.

1.2 This specification does not apply to cast welding fittings.

1.3 Optional supplementary requirements are provided for fittings where a greater degree of examination is desired. These supplementary requirements call for additional tests. When desired, one or more of these may be specified in the order.

1.4 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:

- B 127 Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip²
- B 160 Specification for Nickel Rod and Bar²
- B 161 Specification for Nickel Seamless Pipe and Tube²
- B 162 Specification for Nickel Plate, Sheet, and Strip²
- B 164 Specification for Nickel-Copper Alloy Rod, Bar, and Wire²
- B 165 Specification for Nickel-Copper Alloy (UNS N04400) Seamless Pipe and Tube²
- B 166 Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06025, and N06045) and Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617) Rod, Bar, and Wire²
- B 167 Specification for Nickel-Chromium-Iron Alloy (UNS

- N06600, N06601, and N06690) Seamless Pipe and Tube²
- B 168 Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06025, and N06045) and Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617) Plate, Sheet, and Strip²
- B 333 Specification for Nickel-Molybdenum Alloy Plate, Sheet, and Strip²
- B 335 Specification for Nickel-Molybdenum Alloy Rod²
- B 407 Specification for Nickel-Iron-Chromium Alloy Seamless Pipe and Tube²
- B 408 Specification for Nickel-Iron-Chromium Alloy Rod and Bar²
- B 409 Specification for Nickel-Iron-Chromium Alloy Plate, Sheet, and Strip²
- B 423 Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloy (UNS N08825 and N08221) Seamless Pipe and Tube²
- B 424 Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825 and UNS N08221) Plate, Sheet, and Strip²
- B 425 Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825 and UNS N08221) Rod and Bar²
- B 434 Specification for Nickel-Molybdenum-Chromium-Iron Alloy (UNS N10003, UNS N10242) Plate, Sheet, and Strip²
- B 435 Specification for UNS N06002, UNS N06230, N12160, and UNS R30556 Plate, Sheet, and Strip²
- B 443 Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Plate, Sheet, and Strip²
- B 444 Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Pipe and Tube²
- B 446 Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Rod and Bar²
- B 462 Specification for Forged or Rolled UNS N08020, UNS N08024, UNS N08026, UNS N08367 and UNS R20033 Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service²
- B 463 Specification for UNS N08020, UNS N08026, and UNS N08024 Alloy Plate, Sheet, and Strip²
- B 464 Specification for Welded UNS N08020, N08024, and N08026 Alloy Pipe²

¹ This specification is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.07 on Refined Nickel and Cobalt and Their Alloys.

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² Annual Book of ASTM Standards, Vol 02.04.

- B 468 Specification for Welded UNS N08020, N08024, and N08026 Alloy Tubes²
- B 472 Specification for UNS N08020, UNS N08026, UNS N08024, UNS N08926, UNS N08367, and UNS R20033 Nickel Alloy Billets and Bars for Reforging²
- B 473 Specification for UNS N08020, UNS N08026, and UNS N08024 Nickel Alloy Bar and Wire²
- B 511 Specification for Nickel-Iron-Chromium-Silicon Alloy Bars and Shapes²
- B 512 Specification for Nickel-Chromium-Silicon Alloy (UNS N08330) Billets and Bars²
- B 514 Specification for Welded Nickel-Iron-Chromium Alloy Pipe²
- B 515 Specification for Welded UNS N08800, UNS N08810, and UNS N08811 Alloy Tubes²
- B 516 Specification for Welded Nickel-Chromium-Iron Alloy (UNS N06600), UNS N06025, and UNS N06045 Tubes²
- B 517 Specification for Welded Nickel-Chromium-Iron Alloy (UNS N06600), UNS N06025, and UNS N06045 Pipe²
- B 535 Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and UNS N08332) Seamless Pipe²
- B 536 Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and N08332) Plate, Sheet, and Strip²
- B 564 Specification for Nickel Alloy Forgings²
- B 572 Specification for UNS N06002, UNS N06230, N12160, and UNS R30556 Rod²
- B 573 Specification for Nickel-Molybdenum-Chromium-Iron Alloy (UNS N10003, UNS N10242) Rod²
- B 574 Specification for Low-Carbon Nickel-Molybdenum-Chromium, Low-Carbon Nickel-Chromium-Molybdenum, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod²
- B 575 Specification for Low-Carbon Nickel-Molybdenum-Chromium, Low-Carbon Nickel-Chromium-Molybdenum, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Plate, Sheet, and Strip²
- B 581 Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Rod²
- B 582 Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip²
- B 619 Specification for Welded Nickel and Nickel-Cobalt Alloy Pipe²
- B 622 Specification for Seamless Nickel and Nickel-Cobalt Alloy Pipe and Tube²
- B 625 Specification for UNS N08904, UNS N08925, UNS N08031, UNS N08932, UNS N08926, and UNS R20033 Plate, Sheet, and Strip²
- B 626 Specification for Welded Nickel and Nickel-Cobalt Alloy Tube²
- B 649 Specification for Ni-Fe-Cr-Mo-Cu Low-Carbon Alloy (UNS N08904), Ni-Fe-Cr-Mo-Cu-N Low-Carbon Alloys (UNS N08925, UNS N08031, and UNS N08926), and Cr-Ni-Fe-N Low Carbon Alloy (UNS R20033) Bar and Wire²
- B 673 Specification for UNS N08904, N08925, and N08926 Welded Pipe²
- B 674 Specification for UNS N08904, N08925, and N08926 Welded Tube²
- B 675 Specification for UNS N08366 and UNS N08367 Welded Pipe²
- B 676 Specification for UNS N08366 and UNS N08367 Welded Tube²
- B 677 Specification for UNS N08904, N08925, and N08926 Seamless Pipe and Tube²
- B 688 Specification for Chromium-Nickel-Molybdenum-Iron (UNS N08366 and UNS N08367) Plate, Sheet, and Strip²
- B 690 Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Seamless Pipe and Tube²
- B 691 Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Rod, Bar, and Wire²
- B 704 Specification for Welded UNS N06625, N06219, and UNS N08825 Alloy Tubes²
- B 705 Specification for Nickel-Alloy (UNS N06625, N06219, and N08825) Welded Pipe²
- B 710 Specification for Nickel-Iron-Chromium-Silicon Alloy Welded Pipe²
- E 165 Test Method for Liquid Penetrant Examination³
- E 1916 Guide for Identification and/or Segregation of Mixed Lots of Metals⁴
- 2.2 *ASME Standards:*
- B16.9 Wrought Steel Butt Welding Fittings⁵
- B16.11 Forged Steel Fittings, Socket-Welding and Threaded⁵
- B16.28 Wrought Steel Butt Welding Short Radius Elbows and Returns⁵
- H34.1 Nickel Seamless Pipe and Tubing⁵
- H34.2 Nickel-Copper Alloy Seamless Pipe and Tubing⁵
- H34.3 Nickel-Chromium-Iron Alloy Seamless Pipe and Tubing⁵
- 2.3 *Manufacturers Standardization Society of the Valve and Fittings Industry Standards:*
- MSS SP-25 Standard Marking Systems for Valves, Fittings, Flanges, and Unions⁶
- MSS SP-43 Standard Practice for Light Weight Stainless Steel Butt Welding Fittings⁶
- MSS SP-95 Sewage (D) Nipples and Bull Plugs⁶
- MSS SP-97 Forged Carbon Steel Branch Outlet Fittings—Socket Welding, Threaded and Butt Welding Ends⁶
- Boiler and Pressure Vessel Code, Section VIII, Division 1, Pressure Vessels and Section IX, Welding Qualifications⁵
- 2.5 *AWS Standards:*
- A5.11 Specification for Nickel and Nickel Alloy Covered Welding Electrodes⁷

³ *Annual Book of ASTM Standards*, Vol 03.03.

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

⁵ Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

⁶ Available from Manufacturers' Standardization Society of the Valve and Fittings Industry, 1815 N. Fort Myer Drive, Arlington, VA 22209.

⁷ Available from American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33135.

A5.14 Specification for Nickel and Nickel-Alloy Bare Welding Rods and Electrodes⁷

3. Ordering Information

3.1 Orders for fittings under this specification should include the following information:

- 3.1.1 Quantity, number of fittings of each kind,
- 3.1.2 Description of Fitting and Nominal Dimensions (standard or special),
- 3.1.3 Alloy Composition,
- 3.1.4 Class **WP***S**, **WP***W**, **WP***WX**, or **CR***** shall be specified.
 - 3.1.4.1 Class **CR** fittings shall not be substituted for fittings ordered to Class **WP**, but Class **WP** may be substituted for Class **CR**.
 - 3.1.4.2 Unless Class **WP***S**, **WP***W**, or **WP***WX** is specified by the purchaser, any may be furnished at the option of the supplier.
- 3.1.5 Heat Treatment (4.3 and Appendix X1),
- 3.1.6 *Purchaser Inspection*—State which tests or inspections are to be witnessed (Section 9),
- 3.1.7 *Samples for Product (Check) Analysis*—State whether samples shall be furnished (5.3),
- 3.1.8 Mill test reports (Section 11), and
- 3.1.9 Supplementary requirements, if any.

4. Materials and Manufacture

4.1 *Material*—The material for wrought welding fittings may consist of forgings, rods, bars, plates, sheets, and seamless or welded pipe that conform to all the requirements of the ASTM specifications for the particular product and alloy referred to in Table 1.

4.2 *Manufacture*:

4.2.1 Forging or shaping operations may be performed by hammering, pressing, piercing, extruding, upsetting, rolling, bending, or 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.

4.2.2 Fittings ordered as Class **WP***S** shall be of seamless construction and shall meet all requirements of ASME B16.9, B16.11, or B16.28.

4.2.3 All classes of fittings shall have the welders, welding operators, and welding procedures qualified under the provisions of Section IX of the ASME Boiler and Pressure Vessel Code.

4.2.4 Fittings ordered as Class **WP***W** shall meet the requirements of ASME B16.9 or B16.28 and shall have all welds made by the fitting manufacturer 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, except as exempt by 4.2.4.1, and 4.2.4.2.

4.2.4.1 The weld in the starting pipe, made to one of the pipe or tube product specifications listed in Table 1, shall not require radiography, provided that no filler metal is used in making the weld.

4.2.4.2 . Instead of the radiographic examination, and at the option of the manufacturer, welds made by the fitting manufacturer may be ultrasonically examined in accordance with

Appendix XII of Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code.

4.2.5 Fittings ordered as Class **WP***WX** shall meet the requirements of ASME 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 1, of the ASME Boiler and Pressure Vessel Code, except as exempt by 4.2.5.1. The radiography for this class of fittings may be done either prior to or after forming at the option of the manufacturer.

4.2.5.1 Instead of the radiographic examination, and at the option of the manufacturer, welds made by the fitting manufacturer may be ultrasonically examined in accordance with Appendix XII of Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code.

4.2.6 Fittings covered in MSS SP-43, MSS SP-95, or MSS SP-97 and ordered as **CR***** shall meet the requirements of MSS SP-43, MSS SP-95, or MSS SP-97, respectively, and do not require radiography.

4.2.7 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.

4.2.8 Radiographic examination of the weld buildup on cold-formed stub ends shall not be required provided that all the following steps are adhered to:

4.2.8.1 The weld procedure and welders or welding operators meet the requirements of 4.2.3.

4.2.8.2 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.

4.2.8.3 Repair of areas in the weld is permitted, but 4.2.8.1 and 4.2.8.2 must be repeated.

4.2.8.4 Fittings shall be marked with the symbol WBU following the alloy designation (for example: WPN-WBU).

4.3 *Heat Treatment*—Heat treatment, if required, shall be as agreed upon between the manufacturer and the purchaser.

5. Chemical Composition

5.1 The material shall conform to the requirements as to chemical composition for the respective material prescribed in Table 1.

5.2 Records of chemical analysis made in accordance with the applicable specification listed in Table 1 shall be certification that the material of the fitting meets the requirements of this specification.

5.3 If a product (check) analysis is made by the purchaser, the material shall conform to the requirements for product (check) analysis prescribed for the respective product in Table 1.

5.4 In fittings of welded construction, the alloy content of the deposited weld metal shall conform to that required of the base metal or for equivalent weld metal as given in the AWS Filler Metal Specification A 5.11 and A 5.14.

6. Mechanical Properties and Other Requirements

6.1 *Tensile Requirements*:

6.1.1 Material used in the manufacture of the fittings shall