



Designation: B366/B366M – 16

## Standard Specification for Factory-Made Wrought Nickel and Nickel Alloy Fittings<sup>1</sup>

This standard is issued under the fixed designation B366/B366M; 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 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, MSS SP-43, MSS SP-95, and MSS SP-97.

1.1.1 Several grades of nickel and nickel alloys are included in this specification. Grades are designated with a prefix, WP or CR, based on the applicable ASME or MSS dimensional and rating standards.

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

1.1.3 For each of the WP nickel and nickel alloy grades, several classes of fittings are covered to indicate whether seamless or welded construction was utilized. Class designations are also utilized to indicate the nondestructive test method and extent of nondestructive examination (NDE). Table 1 is general summary of the fitting classes applicable to all WP grades of nickel and nickel alloys covered by this specification. There are no classes for the CR grades. Specific requirements are covered elsewhere.

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 either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

<sup>1</sup> 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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1.5 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 become familiar with all hazards including those identified in the appropriate Safety Data Sheet (SDS) for this product/material as provided by the manufacturer, to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

B127 Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip

B160 Specification for Nickel Rod and Bar

B161 Specification for Nickel Seamless Pipe and Tube

B162 Specification for Nickel Plate, Sheet, and Strip

B163 Specification for Seamless Nickel and Nickel Alloy Condenser and Heat-Exchanger Tubes

B164 Specification for Nickel-Copper Alloy Rod, Bar, and Wire

B165 Specification for Nickel-Copper Alloy (UNS N04400) Seamless Pipe and Tube

B166 Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617), and Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674) Rod, Bar, and Wire

B167 Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617), and Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674) Seamless Pipe and Tube

B168 Specification for Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617), and Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674) Plate, Sheet, and Strip

<sup>2</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.

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



TABLE 1 Fitting Classes for WP Grades

Class	Construction	Nondestructive Examination
S	Seamless	None
W	Welded	Radiography or Ultrasonic
WX	Welded	Radiography
WU	Welded	Ultrasonic

- [B333](#) Specification for Nickel-Molybdenum Alloy Plate, Sheet, and Strip
- [B335](#) Specification for Nickel-Molybdenum Alloy Rod
- [B407](#) Specification for Nickel-Iron-Chromium Alloy Seamless Pipe and Tube
- [B408](#) Specification for Nickel-Iron-Chromium Alloy Rod and Bar
- [B409](#) Specification for Nickel-Iron-Chromium Alloy Plate, Sheet, and Strip
- [B423](#) Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloy (UNS N08825, N08221, and N06845) Seamless Pipe and Tube
- [B424](#) Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825, UNS N08221, and UNS N06845) Plate, Sheet, and Strip
- [B425](#) Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825, UNS N08221, and UNS N06845) Rod and Bar
- [B434](#) Specification for Nickel-Molybdenum-Chromium-Iron Alloys (UNS N10003, UNS N10242) Plate, Sheet, and Strip
- [B435](#) Specification for UNS N06002, UNS N06230, UNS N12160, and UNS R30556 Plate, Sheet, and Strip
- [B443](#) Specification for Nickel-Chromium-Molybdenum-Columbium Alloy(UNS N06625) and Nickel-Chromium-Molybdenum-SiliconAlloy (UNS N06219) Plate, Sheet, and Strip
- [B444](#) Specification for Nickel-Chromium-Molybdenum-Columbium Alloys (UNS N06625 and UNS N06852) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Pipe and Tube
- [B446](#) Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625), Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219), and Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06650) Rod and Bar
- [B462](#) Specification for Forged or Rolled UNS N06030, UNS N06022, UNS N06035, UNS N06200, UNS N06059, UNS N10362, UNS N06686, UNS N08020, UNS N08367, UNS N10276, UNS N10665, UNS N10675, UNS N10629, UNS N08031, UNS N06045, UNS N06025, UNS R20033 Alloy Pipe Flanges, Forged Fittings
- [B463](#) Specification for UNS N08020 Alloy Plate, Sheet, and Strip
- [B464/B464M](#) Specification for Welded UNS N08020 Alloy Pipe
- [B468](#) Specification for Welded UNS N08020 Alloy Tubes
- [B472](#) Specification for Nickel Alloy Billets and Bars for Reforging
- [B473](#) Specification for UNS N08020, UNS N08024, and UNS N08026 Nickel Alloy Bar and Wire

- [B511](#) Specification for Nickel-Iron-Chromium-Silicon Alloy Bars and Shapes
- [B512](#) Specification for Nickel-Chromium-Silicon Alloy (UNS N08330) Billets and Bars
- [B514](#) Specification for Welded Nickel-Iron-Chromium Alloy Pipe
- [B515](#) Specification for Welded UNS N08120, UNS N08800, UNS N08810, and UNS N08811 Alloy Tubes
- [B516](#) Specification for Welded Nickel-Chromium-Iron Alloy (UNS N06600, UNS N06601, UNS N06603, UNS N06025, UNS N06045, UNS N06690, and UNS N06693) Tubes
- [B517](#) Specification for Welded Nickel-Chromium-Iron-Alloy (UNS N06600, UNS N06603, UNS N06025, and UNS N06045) Pipe
- [B535](#) Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and N08332) Seamless Pipe and Tube
- [B536](#) Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and N08332) Plate, Sheet, and Strip
- [B564](#) Specification for Nickel Alloy Forgings
- [B572](#) Specification for UNS N06002, UNS N06230, UNS N12160, and UNS R30556 Rod
- [B573](#) Specification for Nickel-Molybdenum-Chromium-Iron Alloys (UNS N10003, N10242) Rod
- [B574](#) Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Molybdenum-Chromium, Low-Carbon Nickel-Molybdenum-Chromium-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod
- [B575](#) Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, Low-Carbon Nickel-Chromium-Molybdenum-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Tungsten, and Low-Carbon Nickel-Molybdenum-Chromium Alloy Plate, Sheet, and Strip
- [B581](#) Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Rod
- [B582](#) Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip
- [B619/B619M](#) Specification for Welded Nickel and Nickel-Cobalt Alloy Pipe
- [B622](#) Specification for Seamless Nickel and Nickel-Cobalt Alloy Pipe and Tube
- [B625](#) Specification for UNS N08925, UNS N08031, UNS N08932, UNS N08926, UNS N08354, UNS N08830, and UNS R20033 Plate, Sheet, and Strip
- [B626](#) Specification for Welded Nickel and Nickel-Cobalt Alloy Tube
- [B649](#) Specification for Ni-Fe-Cr-Mo-Cu-N Low-Carbon Alloys (UNS N08925, UNS N08031, UNS N08354, and UNS N08926), and Cr-Ni-Fe-N Low-Carbon Alloy (UNS R20033) Bar and Wire, and Ni-Cr-Fe-Mo-N Alloy (UNS N08936) Wire
- [B673](#) Specification for UNS N08925, UNS N08354, and UNS N08926 Welded Pipe
- [B674](#) Specification for UNS N08925, UNS N08354, and UNS N08926 Welded Tube



- B675 Specification for UNS N08367 Welded Pipe
- B676 Specification for UNS N08367 Welded Tube
- B677 Specification for UNS N08925, UNS N08354, and UNS N08926 Seamless Pipe and Tube
- B688 Specification for Chromium-Nickel-Molybdenum-Iron (UNS N08366 and UNS N08367) Plate, Sheet, and Strip
- B690 Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Seamless Pipe and Tube
- B691 Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Rod, Bar, and Wire
- B704 Specification for Welded UNS N06625, UNS N06219 and UNS N08825 Alloy Tubes
- B705 Specification for Nickel-Alloy (UNS N06625, N06219 and N08825) Welded Pipe
- B710 Specification for Nickel-Iron-Chromium-Silicon Alloy Welded Pipe
- B729 Specification for Seamless UNS N08020, UNS N08026, and UNS N08024 Nickel-Alloy Pipe and Tube
- B880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys
- B899 Terminology Relating to Non-ferrous Metals and Alloys
- E165 Practice for Liquid Penetrant Examination for General Industry
- E1916 Guide for Identification of Mixed Lots of Metals
- 2.2 ASME Standards:<sup>3</sup>
  - B16.9 Wrought Steel Butt Welding Fittings
  - B16.11 Forged Steel Fittings, Socket-Welding and Threaded
- 2.3 Manufacturers Standardization Society of the Valve and Fittings Industry Standards:
  - MSS SP-25 Standard Marking Systems for Valves, Fittings, Flanges, and Unions<sup>4</sup>
  - MSS SP-43 Standard Practice for Light Weight Stainless Steel Butt Welding Fittings<sup>4</sup>
  - MSS SP-95 Sewage (D) Nipples and Bull Plugs<sup>4</sup>
  - MSS SP-97 Forged Carbon Steel Branch Outlet Fittings—Socket Welding, Threaded and Butt Welding Ends<sup>4</sup>
  - Boiler and Pressure Vessel Code, Section VIII, Division 1 Pressure Vessels and Section IX, Welding Qualifications<sup>3</sup>
- 2.4 AWS Standards:<sup>5</sup>
  - A5.11 Specification for Nickel and Nickel Alloy Covered Welding Electrodes
  - A5.14 Specification for Nickel and Nickel-Alloy Bare Welding Rods and Electrodes

2.5 ASNT:<sup>6</sup>

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

### 3. Terminology

3.1 Terms defined in Terminology B899 shall apply unless otherwise defined in this standard.

### 4. Ordering Information

4.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Examples of such requirements include, but are not limited to, the following:

- 4.1.1 Quantity, number of fittings of each kind,
- 4.1.2 Description of Fitting and Nominal Dimensions (standard or special),
- 4.1.3 Alloy Composition,
- 4.1.4 Condition (temper) if applicable.
- 4.1.5 If neither grade of N06625 is specified, Grade 1 will be supplied.
- 4.1.6 For each Grade of WP fittings ordered, a Class should also be indicated.
  - 4.1.6.1 Grade **CR** fittings shall not be substituted for fittings ordered to Grade **WP**, but Grade **WP** may be substituted for Grade **CR**.
  - 4.1.6.2 For all Classes of WP fittings, unless S, W, WX, or WU is specified by the purchaser, any class may be furnished at the option of the supplier.
  - 4.1.7 *Purchaser Inspection*—State which tests or inspections are to be witnessed (Section 10),
  - 4.1.8 *Samples for Product (Check Analysis)*—State whether samples should be furnished (6.3),
  - 4.1.9 Test reports (Section 12), and
  - 4.1.10 Supplementary requirements, if any.

### 5. Materials and Manufacture

5.1 *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 2.

5.2 *Manufacture*:

- 5.2.1 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.
- 5.2.2 Grade WP fittings ordered as Class S shall be of seamless construction and shall meet all requirements of ASME B16.9 or B16.11.
- 5.2.3 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.

<sup>3</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

<sup>4</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>5</sup> Available from American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126, <http://www.aws.org>.

<sup>6</sup> Available from American Society for Nondestructive Testing (ASNT), P.O. Box 28518, 1711 Arlingate Ln., Columbus, OH 43228-0518, <http://www.asnt.org>.

**TABLE 2 Permissible Raw Materials**

Corrosion-Resistant Fittings	Marking <sup>A</sup>		Product and ASTM Designation <sup>B</sup>			
	ASME Pressure Fittings	Alloy	UNS Designation	Pipe or Tube	Plate, Sheet, or Strip	Bar Forging and Forging Stock
CRN	WPN	Ni	N02200	B161	B162	B160, B564
CRNL	WPNL	Ni, Low C	N02201	B161	B162	B160
CRNC <sup>C</sup>	WPNC <sup>C</sup>	Ni-Cu	N04400	B165	B127	B164, B564
CR HX	WPHX	Ni-Cr-Mo-Fe	N06002	B619/B619M, B622, B626	B435	B572
CR HG	WPHG	Ni-Cr-Fe-Mo-Cu	N06007	B619/B619M, B622, B626	B582	B581
CR HC 22	WPHC22	Low C-Ni-Mo-Cr	N06022	B619/B619M, B622, B626	B575	B574, B564, B462, B472
CRV602	WPV602	Ni-Cr-Fe	N06025	B163, B167	B168	B166, B462, B472
CR HG 30	WPHG30	Ni-Cr-Fe-Mo-Cu	N06030	B619/B619M, B622, B626	B582	B581, B462, B472
CRHG35	WPHG35	Ni-Cr-Mo	N06035	B619/B619M, B622, B626	B575	B574, B564, B462, B472
CRV45TM	WPV45TM	Ni-Cr-Fe	N06045	B163, B167	B168	B166, B462, B472
CR2120	WP2120	Ni-Cr-Mo low C	N06058	B619/B619M, B622, B626	B575	B564, B574
CR5923	WP5923	Low C-Ni-Cr-Mo	N06059	B619/B619M, B622, B626	B575	B564, B574, B462, B472
CR HC 2000	WPHC2000	Low C-Ni-Cr-Mo-Cu	N06200	B619/B619M, B622, B626	B575	B564, B574, B462, B472
CRM21	WPM21	Low C-Ni-Cr-Mo-Ta	N06210	B619/B619M, B622, B626	B575	B564, B574
CRH230	WPH230	Ni-Cr-W-Mo	N06230	B619/B619M, B622, B626	B435	B572, B564
CRHBC1	WPHBC1	Low C-Ni-Mo-Cr	N10362	B619/B619M, B622, B626	B575	B574, B564, B462, B472
CR HC 4	WPHC4	Low C-Ni-Mo-Cr	N06455	B619/B619M, B622, B626	B575	B574
CRNCI	WPNCI	Ni-Cr-Fe	N06600	B167, B516, B517	B168	B166, B564
CR603GT	WP603GT	Ni-Cr-Fe-Al	N06603	B163, B167, B516, B517	B168	B166, B564
CRNCMC	WPNCMC	Ni-Cr-Mo-Cb	N06625	B444, B704, B705	B443	B446, B564
CRIN686	WPIN686	Low C-Ni-Cr-Mo	N06686	B163, B619/B619M, B622, B626	B575	B564, B574, B462, B472
CR626Si	WP626Si	Ni-Cr-Mo-Si	N06219	B444, B704, B705	B443	B446, B564
CR HG3	WPHG3	Ni-Cr-Fe-Mo-Cu	N06985	B619/B619M, B622, B626	B582	B581
CR20CB	WP20CB	Cr-Ni-Fe-Mo-Cu-Cb stabilized	N08020	B464/B464M, B468, B729	B463	B472, B473, B462
CR3127	WP3127	Low C-Ni-Fe-Cr-Mo-Cu	N08031	B619/B619M, B622, B626	B625	B564, B649, B462, B472
CRH120	WPH120	Ni-Cr-Fe	N08120	B407, B514, B515	B409	B408, B564
CR330	WP330	Ni-Fe-Cr-Si	N08330	B535, B710	B536	B511, B512
CR6XN	WP6XN	Fe-Ni-Cr-Mo-N	N08367	B675, B676, B690	B688	B472, B564, B691, B462
CRNIC	WPNIC	Ni-Fe-Cr	N08800	B407, B514, B515	B409	B408, B564
CRNIC10	WPNIC10	Ni-Fe-Cr	N08810	B407, B514, B515	B409	B408, B564
CRNIC11	WPNIC11	Ni-Fe-Cr	N08811	B407	B409	B408, B564
CRNICMC	WPNICMC	Ni-Fe-Cr-Mo-Cu	N08825	B423, B704, B705	B424	B425, B564
CR1925	WP1925	Low C-Ni-Fe-Cr-Mo-Cu	N08925	B673, B674, B677	B625	B649
CR1925N	WP1925N	Low C-Ni-Fe-Cr-Mo-Cu-N	N08926	B673, B674, B677	B625	B649
CR HB	WPHB	Ni-Mo	N10001	B619/B619M, B622, B626	B333	B335
CR HN	WPHN	Ni-Mo-Cr-Fe	N10003		B434	B573
CR H242	WPH242	Ni-Mo-Cr-Fe	N10242	B619/B619M, B622, B626	B434	B573, B564
CR HC 276	WPHC276	Low C-Ni-Mo-Cr	N10276	B619/B619M, B622, B626	B575	B574, B564, B462, B472
CRB10	WPB10	Low C-Ni-Mo-Cr-Fe	N10624	B619/B619M, B622, B626	B333	B335, B564
CRVB4	WPVB4	Ni-Mo	N10629	B619/B619M, B622, B626	B333	B335, B564, B462, B472
CR HB2	WPHB-2	Ni-Mo	N10665	B619/B619M, B622, B626	B333	B335, B564, B462, B472
CR HB3	WPHB-3	Ni-Mo	N10675	B619/B619M, B622, B626	B333	B335, B564, B462, B472
CRH160	WPH160	Ni-Co-Cr-Si	N12160	B619/B619M, B622, B626	B435	B564, B572
CR3033	WP3033	Low C-Cr-Ni-Fe-N	R20033	B619/B619M, B622, B626	B625	B564, B649, B472, B462
CRH556	WPH556	Ni-Fe-Cr-Co	R30556	B619/B619M, B622, B626	B435	B572

<sup>A</sup> When WP fittings are of welded construction or made from welded pipe, the symbol shall be supplemented with W or WX as applicable. If ultrasonic examination in accordance with 5.2.4.2 or 5.2.5.1 is used, the symbol shall be supplemented by WU or WXU as applicable.

<sup>B</sup> See 2.1 and 5.1.

<sup>C</sup> Yield strength shall be 25 000 psi (172 MPa) min, for all hot-formed, annealed fittings made from WPNC material.

5.2.4 Grade WP fittings ordered as Class W shall meet the requirements of ASME B16.9 and shall have all pipe welds made by the starting material manufacturer or the fitting