Designation: B366/B366M – 17

Standard Specification for Factory-Made Wrought Nickel and Nickel Alloy Fittings[1]

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 (ε) 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.

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.*

1.6 *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:*[2]

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

[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.

Current edition approved June 1, 2017. Published June 2017. Originally approved in 1961. Last previous edition approved in 2016 as B366/B366M – 16. DOI: 10.1520/B0366_B366M-17.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at 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

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

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:* [3]
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[4]
MSS SP-43 Standard Practice for Light Weight Stainless Steel Butt Welding Fittings[4]
MSS SP-95 Sewage (D) Nipples and Bull Plugs[4]
MSS SP-97 Forged Carbon Steel Branch Outlet Fittings–Socket Welding, Threaded and Butt Welding Ends[4]
Boiler and Pressure Vessel Code, Section VIII, Division 1 Pressure Vessels and Section IX, Welding Qualifications[3]

2.4 *AWS Standards:*[5]
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:*[6]
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.

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

[4] Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, http://www.mss-hq.com.

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

[6] 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

Marking[A]				Product and ASTM Designation[B]		
Corrosion-Resistant Fittings	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[C]	WPNC[C]	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
CR MC	WPHMC	Ni-Cr-Mo	N06044	B619/B619M, B622, B626	B575	B574, B564
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

[A] 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.

[B] See 2.1 and 5.1.

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

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.

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 manufacturer with the addition of filler 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 5.2.4.1, and 5.2.4.2.

5.2.4.1 The weld in the starting pipe, made to one of the pipe or tube product specifications listed in Table 2, shall not require radiography, provided that no filler metal is used in making the weld.

5.2.4.2 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 the Code requirements stated in 5.2.6.

5.2.5 Grade WP fittings ordered as Class WX shall meet the requirements of ASME B16.9 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 5.2.5.1. The radiography for this class of fittings may be done either prior to or after forming at the option of the manufacturer.

5.2.5.1 Instead of the radiographic examination, and at the option of the manufacturer, welds, whether made by the fitting manufacturer or the starting material manufacturer, may be ultrasonically examined in accordance with the Code requirements stated in 5.2.6.

5.2.6 Grade WP fittings ordered as Class WU shall meet the requirements of ASME B16.9 and shall have all welds, whether made by the fitting manufacturer of the starting material manufacturer, ultrasonically examined throughout their entire length in accordance with Appendix 12 of Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code. The ultrasonic examination of welds for this class may be performed either prior to or after forming at the option of the manufacturer.

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

5.2.8 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 non-destructive examination.

5.2.9 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.

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

5.2.10.1 The weld procedure and welders or welding operators meet the requirements of 5.2.3.

5.2.10.2 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.

5.2.10.3 Repair of areas in the weld is permitted, but 5.2.10.1 and 5.2.10.2 must be repeated.

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

5.2.11 Stubends may be produced with the entire lap added as weld metal to a straight pipe section provided the welding satisfies the requirements of 5.2.3 for qualifications and 5.3 for heat treatment.

5.2.11.1 Grade **WP****Class W** – Radiographic examination of the welds, made with the addition of filler metal, is required. See 5.2.4.

5.2.11.2 Grade **WP****Class WX** – Radiographic examination of all welds, made with or without the addition of filler metal is required. See 5.2.5.

5.2.11.3 Grade **WP****Class WU** – Ultrasonic examination of all welds, made with or without the addition of filler metal, is required. See 5.2.6.

5.2.11.4 Grade **CR** – Nondestructive examination is not required. See 5.2.8.

5.2.12 Stubends may be produced with the entire lap added by the welding of a ring, made from plate or flat bar of the same alloy grade and composition, to the outside of a straight section of pipe, provided the weld is a double welded full penetration joint and satisfies the requirements of 5.2.3 for qualifications and 5.3 for heat treatment.

5.2.12.1 Grade **WP****Class W** – Radiographic examination of all welds, made with the addition of filler metal, is required. See 5.2.4.

5.2.12.2 Grade **WP****Class WX** – Radiographic examination of all welds, made with or without the addition of filler metal, is required. See 5.2.5.

5.2.12.3 Grade **WP****Class WU** – Ultrasonic examination of all welds, made with or without the addition of filler metal, is required. See 5.2.6.

5.2.12.4 Grade **CR** – Nondestructive examination is not required. See 5.2.8.

5.3 *Heat Treatment*—All fittings shall be furnished heat treated. See Table 3 for recommended heat treatments. All forming or welding shall be done and completed prior to any final heat treatment. For seamless fittings made without forming, heat treatment, if any, shall be agreed upon between purchaser and manufacturer.

6. Chemical Composition

6.1 The material shall conform to the requirements as to chemical composition for the respective material prescribed in Table 2.

6.2 Records of chemical analysis made in accordance with the applicable specification listed in Table 2 shall be certification that the material of the fitting meets the requirements of this specification.

TABLE 3 Heat Treatment

Corrosion-Resistant Fittings	ASME Pressure Fittings	Alloy	UNS Designation	Heat Treatment[A,B] DEG °F [°C]	Quench
CRN	WPN	Ni	N02200	1650-1700 [900-928]	Rapid Air/Water
CRNL	WPNL	Ni, Low C	N02201	1650-1700 [900-928]	Rapid Air/Water
CRNC[C]	WPNC[C]	Ni-Cu	N04400	1650-1700 [900-928]	Rapid Air/Water
CR HX	WPHX	Ni-Cr-Mo-Fe	N06002	2150 [1177][D]	Rapid Air/Water
CR HG	WPHG	Ni-Cr-Fe-Mo-Cu	N06007	2100-2150 [1150-1177]	Rapid Air/Water
CR HC 22	WPHC22	Low C-Ni-Mo-Cr	N06022	2050 [1121][D]	Rapid Air/Water
CRV602	WPV602	Ni-Cr-Fe	N06025	2200 [1204][E]	Rapid Air/Water
CR HG 30	WPHG30	Ni-Cr-Fe-Mo-Cu	N06030	2150 [1177][D]	Rapid Air/Water
CRHG35	WPHG35	Ni-Cr-Mo	N06035	2050 [1121]	Rapid Air/Water
CR MC	WPHMC	Ni-Cr-Mo	N06044	2100-2230 [1150-1220]	Rapid Air/Water
CRV45TM	WPV45TM	Ni-Cr-Fe	N06045	2150 [1177]	Rapid Air/Water
CR5923	WP5923	Low C-Ni-Cr-Mo	N06059	2050 [1121]	Rapid Air/Water
CR HC 2000	WPHC2000	Low C-Ni-Cr-Mo-Cu	N06200	2075-2125 [1135-1163]	Rapid Air/Water
CRM21	WPM21	Low C-Ni-Cr-Mo-Ta	N06210	[E]	[E]
CRH230	WPH230	Ni-Cr-W-Mo	N06230	2150-2250 [1177-1232]	Rapid Air/Water
CRHBC1	WPHBC1	Low C-Ni-Mo-Cr	N10362	2100[B] [1147]	Rapid Air/Water
CR HC 4	WPHC4	Low C-Ni-Mo-Cr	N06455	1950 [1065][D]	Rapid Air/Water
CRNCI	WPNCI	Ni-Cr-Fe	N06600	1800-1850 [983-1010]	Rapid Air/Water
CR603GT	WP603GT	Ni-Cr-Fe-Al	N06603	2175 [1189]	Rapid Air/Water
CRNCMC	WPNCMC	Ni-Cr-Mo-Cb	N06625 Gr 1	1600 [871]	Rapid Air/Water
CRNCMC	WPNCMC	Ni-Cr-Mo-Cb	N06625 Gr 2	2000 [1093][D]	Rapid Air/Water
CRIN686	WPIN686	Low C-Cr-Ni-Mo	N06686	2150 [1177]	Rapid Air/Water
CR626Si	WP626Si	Ni-Cr-Mo-Si	N06219	2050 [1121]	Rapid Air/Water
CR HG3	WPHG3	Ni-Cr-Fe-Mo-Cu	N06985	2100-2150 [1147-1177]	Rapid Air/Water
CR20CB	WP20CB	Cr-Ni-Fe-Mo-Cu-Cb stabilized	N08020	1700-1850 [927-1010]	Rapid Air/Water
CR3127	WP3127	Low C-Ni-Fe-Cr-Mo-Cu	N08031	2175 [1189]	Rapid Air/Water
CRH120	WPH120	Ni-Cr-Fe	N08120	2175-2225 [1189-1220]	Rapid Air/Water
CR330	WP330	Ni-Fe-Cr-Si	N08330	1900 [1038]	Rapid Air/Water
CR6XN	WP6XN	Fe-Ni-Cr-Mo-N	N08367	2025 [1107]	Rapid Air/Water
CRNIC	WPNIC	Ni-Fe-Cr	N08800	1800-1900 [983-1038][F]	Rapid Air/Water
CRNIC10	WPNIC10	Ni-Fe-Cr	N08810	2100-2150 [1147-1177][F]	Rapid Air/Water
CRNIC11	WPNIC11	Ni-Fe-Cr	N08811	2100-2150 [1147-1177][F]	Rapid Air/Water
CRNICMC	WPNICMC	Ni-Fe-Cr-Mo-Cu	N08825	1700-1800 [930-983][F]	Rapid Air/Water
CR1925	WP1925	Low C-Ni-Fe-Cr-Mo-Cu	N08925	1800-1900 [983-1038]	Rapid Air/Water
CR2120	WP2120	Low C-Ni-Cr-Mo	N06058	2075 [1135]	Rapid Air/Water
CR1925N	WP1925N	Low C-Ni-Fe-Cr-Mo-Cu-N	N08926	2150 [1177]	Rapid Air/Water
CRHB	WPHB	Ni-Mo	N10001	1950 [1065][D]	Rapid Air/Water
CRHN	WPHN	Ni-Mo-Cr-Fe	N10003	2150 [1177][D]	Rapid Air/Water
CR H242	WPH242	Ni-Mo-Cr-Fe	N10242	1925-2025 [1050-1105]	Rapid Air/Water
CR HC 276	WPHC276	Low C-Ni-Mo-Cr	N10276	2050 [1121][D]	Rapid Air/Water
CRB10	WPB10	Low C-Ni-Mo-Cr-Fe	N10624	2050 [1121]	Rapid Air/Water
CRVB4	WPVB4	Ni-Mo	N10629	1975 [1080]	Rapid Air/Water
CR HB2	WPHB2	Ni-Mo	N10665	1950 [1065][D]	Rapid Air/Water
CR HB3	WPHB3	Ni-Mo	N10675	1950 [1065][D]	Rapid Air/Water
CRH160	WPH160	Ni-Co-Cr-Si	N12160	2025 [1107][D]	Rapid Air/Water
CR3033	WP3033	Low C-Cr-Ni-Fe-N	R20033	2050 [1121]	Rapid Air/Water
CRH556	WPH556	Ni-Fe-Cr-Co	R30556	2150 [1177][D]	Rapid Air/Water

[A] Recommended set temperatures – Different temperatures may be selected by either the purchaser or the manufacturer.
[B] Set temperature, ±25°F [15°C].
[C] Yield strength shall be 25 000 psi [172 MPa] min, for all hot-formed, annealed fittings made from WPNC material.
[D] Minimum temperature.
[E] Annealing temperature and quench shall be agreed upon between purchaser and manufacturer.
[F] Heat treatment is highly dependent on intended service temperature – consult material manufacturer for specific heat treatments for end use temperature.

6.3 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 2 and Specification B880 for check analysis.

6.4 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 A5.11 and A5.14.

7. Mechanical Properties and Other Requirements

7.1 *Tensile Requirements:*

7.1.1 (All Table 2 alloys except for UNS N06625 Grade 1 or Grade 2).

7.1.1.1 Material used in the manufacture of the fittings shall conform to the requirements for tensile properties as prescribed for the respective product in Table 2.

7.1.1.2 Finished fittings shall conform to the properties for the respective material and temper as prescribed in the specifications referred to in Table 2. When required, the properties of fittings made from forging stock shall be as agreed upon between the producer and the purchaser.

7.1.1.3 Tension tests of the finished fittings are not required, unless otherwise agreed upon between the manufacturer and the purchaser.

7.1.2 *Tensile Requirements* (For fittings made to meet the mechanical properties of UNS N06625 Grade 1)*:*

7.1.2.1 At the option of the manufacturer, the material used in the manufacture of UNS N06625 Grade 1 fittings shall conform to the mechanical property requirements of either UNS N06625 Grade 1 or Grade 2 as prescribed for the respective product in Table 2.

7.1.2.2 Tension tests are required in accordance with 7.1.2.3.

7.1.2.3 Tension tests are required per lot (Note S2.3) per furnace charge. Tension specimens may be obtained from a fitting or a representative test piece (Note S2.2). Tension specimens representing fittings of welded construction, made with the addition of filler metal, are to include the weld and be prepared so that the weld is at the specimen's midlength location.

7.1.2.4 The finished fittings shall conform to the minimum UNS N06625 Grade 1 mechanical properties as prescribed for the respective starting raw material product listed in Table 2 except that fittings of welded construction are exempt from the tensile ductility requirement (elongation) and the yield strength requirements. The minimum mechanical properties for fittings made from forging stock shall be as agreed upon between manufacturer and purchaser.

7.1.3 *Tensile Requirements (*For fittings made to meet the mechanical properties of UNS N06625 Grade 2*):*

7.1.3.1 At the option of the manufacturer, the material used in the manufacture of UNS N06625 Grade 2 fittings shall conform to the mechanical property requirements of either UNS N06625 Grade 1 or Grade 2 as prescribed for the respective product in Table 2.

7.1.3.2 Tension tests are not required provided the grade of starting raw material is designated as UNS N06625 Grade 2 in the raw material manufacturer's MTR description and the final heat treat temperature of the fittings is in compliance with the recommended solution annealing heat treat procedure for the grade. Tension tests are required if the grade of starting raw material is designated as UNS N06625 Grade 1 in the raw material manufacturer's MTR description.

7.1.3.3 Tension tests, if required, are to be performed per lot (Note S2.3) provided that all heat treatments are performed in furnaces controlled within a ±25°F [15°C] range of set point and are equipped with calibrated recording pyrometers so that all other subsequent heat treatments can be conducted within the same ±25°F [15°C] temperature range as the furnace charge that contained the test specimen. Tension specimens may be obtained from a fitting or a representative test piece. In this paragraph only, a representative test piece is defined as a test specimen from the same heat of fitting raw material having approximately the same amount of working. In addition, the test piece representing fittings manufactured from bars, plate or forgings shall have a cross section equal to the greatest cross section of the fitting, a test piece representing fittings manufactured from pipe shall have an outside diameter and wall thickness equal to those of the fitting and a test piece for fittings of welded construction, made with the addition of filler metal, shall be prepared to the same welding procedures and from the same heat of material as the fittings it represents. Tension specimens representing fittings of welded construction, made with the addition of filler metal, are to include the weld and be prepared so that the weld is at the specimen's midlength location.

7.1.3.4 The finished fittings shall conform to the minimum UNS N06625 Grade 2 mechanical properties as prescribed for the representative starting raw material product listed in Table 2 except that fittings of welded construction are exempt from the tensile ductility requirement (elongation) and the yield strength requirements. The minimum mechanical properties for fittings made from forging stock shall be as agreed upon between manufacturer and purchaser.

7.2 *Hydrostatic Tests:*

7.2.1 Hydrostatic testing of wrought fittings is not required by this specification.

7.2.2 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 with which the fitting is recommended to be used.

8. Dimensions

8.1 Fittings or components produced in accordance with this specification shall have sizes, shapes, and dimensions in accordance with those specified in ASME B16.9, ASME B16.11, MSS SP-43, MSS SP-95, MSS SP-97.

9. Workmanship, Finish, and Appearance

9.1 The fittings shall be free of injurious defects and have a workmanlike finish. Minor defects may be removed by grinding, provided the wall thickness is not decreased to less than the allowable specification minimum and provided the grinding is smooth and leaves no shoulders.

9.2 The fittings shall be cleaned free of scale.

10. Inspection

10.1 Inspection of the material by the purchaser at the place of manufacture shall be made as agreed upon between the purchaser and the manufacturer as part of the purchase contract.

11. Rejection and Rehearing

11.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

12. Certifications

12.1 Test reports are required for all fittings covered by this specification. Each test report shall include the following information:

TABLE 4 Product Marking Examples for Grades and Classes

Grade and Class Marking	Description
CRN	Single grade: no classes in CR grades
CRN/NL	Multiple grades, meet chemical and mechanical properties of each
WPN-S	Single grade: seamless
WPN-W	Single grade: welded: RT or UT pipe welds with filler metal and all fitting manufacturer's welds
WPN-WX	Single grade: welded: RT all welds with or without filler metal
WPN-WU	Single grade: welded: UT all welds with or without filler metal
WPN/NL-S	Multiple grades: meet chemical and mechanical properties of each: seamless

12.1.1 The year-date of the specification and class to which the fitting was furnished,

12.1.2 Heat numbers or serial number traceable to heat numbers,

12.1.3 Chemical analyses for all starting materials,

12.1.4 Mechanical properties for all starting materials, or actual mechanical properties if tension testing was required,

12.1.5 For construction with filler metal added, weld metal chemical analyses or AWS classification,

12.1.6 For welded stub ends, the construction method per 5.2.11 or 5.2.12 shall be stated,

12.1.7 Heat treatment per Table 3,

12.1.8 Results of all nondestructive examinations,

12.1.9 Results of all tests required by Supplementary Requirements and the order, and

12.1.10 Statement that the fitting was manufactured, sampled, tested and inspected in accordance with the specification and was found to meet the requirements.

13. Product Marking

13.1 The manufacturer's name or trademark, material, grade, if applicable, the size and schedule number, the designation as shown in Table 2, under "Marking," either column 1 for Grade CR fittings or column 2 for Grade WP fittings, shall be stamped, stenciled, or otherwise permanently marked on each fitting. Grade WP fitting marking also must include the suffix in accordance with 5.2. On wall thicknesses thinner than 0.083 in. [2.1 mm], no steel 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 MSS SP-25. See Table 4 for marking example of grades and classes.

NOTE 1—When steel stamps are used, the marking shall not be deep enough to cause cracks or to reduce the wall thickness of the fittings below the minimum allowed by the applicable specification.

14. Keywords

14.1 nickel alloy fittings

SUPPLEMENTARY REQUIREMENTS

These requirements shall not be considered unless specified in the order, in which event the supplementary requirements specified shall be made at the place of manufacture, unless otherwise agreed upon.

S1. Product Analysis (Note S2.1)

S1.1 A product analysis shall be made from each heat of base metal and, if of welded construction, from each lot (Note S2.3) number of welding material of the fittings offered for delivery. The analysis shall conform to the requirements specified in Section 6.

S2. Tension Test (Note S2.1)

S2.1 One tension test shall be made on one fitting or representative test piece (Note S2.2) per lot (Note S2.3) of fittings. If the fittings are of welded construction, made with the addition of filler metal, the tension specimen shall include the weld and be prepared so that the weld is at the midlength location of the specimen. However, in no case shall the tensile properties of the finished fittings be less than the requirements of the pipe specifications listed in Table 2, except that weld specimens are exempt from the tensile ductility requirements.

NOTE S2.1—If the results of any of the tests specified in Sections S1 or S2 do not conform to requirements, retests may be made at the manufacturer's expense on additional fittings or representative test pieces of double the original number from the same heat or lot as defined in Section S1 or S2. If either of the additional test pieces fails, the lot shall be rejected.

NOTE S2.2—*Representative Test Piece:* Where the test specimen for the tension test cannot be taken from a fitting due to size limitations, a representative test shall be obtained. The test piece shall be from the same heat and heat treated in the same batch or charge as the fittings it represents, and shall have approximately the same amount of working. In addition, test pieces representing fittings manufactured from bars, plate, or forgings shall have a cross section equal to the greatest cross section of the fitting, and test pieces representing fittings manufactured from pipe shall

have an outside diameter and wall thickness equal to those of the fitting. The test piece for fittings of welded construction, made with the addition of filler metal, shall be prepared to the same weld procedures and from the same heats of material as the fittings it represents.

NOTE S2.3—A lot shall consist of all fittings of the same type, size, and wall thickness, manufactured from one heat of material, and, if welding is performed, using the same size and AWS classification welding product.

S3. Liquid Penetrant Test

S3.1 All surfaces shall be liquid penetrant tested. The method shall be in accordance with Practice E165. Acceptance limits shall be as specified by the purchaser.

S4. Hydrostatic Test

S4.1 A hydrostatic test shall be applied as agreed upon between the manufacturer and purchaser.

S5. Bar Stock Fittings

S5.1 Fittings machined from solid bar stock are not permitted.

S6. Positive Material Identification Examination

S6.1 Product shall receive Positive Material Identification to ensure that the purchaser is receiving product of the correct material grade prior to shipment of the product. This examination is a method to assure that no material grade mix-up has happened during manufacturing and marking of the product.

S6.2 Product shall receive a Positive Material Identification examination by Guide E1916.

S6.3 The quantity examined shall be 100 % of the product.

S6.4 All product that is not of the correct material grade shall be rejected.

S6.5 The method of product marking after examination shall be agreed upon between the manufacturer and purchaser.

SUMMARY OF CHANGES

Committee B02 has identified the location of selected changes to this standard since the last issue (B366/B366M–16) that may impact the use of this standard. (Approved June 1, 2017.)

(1) Addition of new Ni-Cr-Mo alloy to Table 2 Permissible Raw Materials.

(2) Addition of new Ni-Cr-Mo alloy to Table 3 Heat Treatment.

Committee B02 has identified the location of selected changes to this standard since the last issue (B366/B366M–15) that may impact the use of this standard. (Approved May 1, 2016.)

(1) References to ASME H34.1, H34.2, and H34.3 were removed.