Designation: B 366 – 97a

An American National Standard

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

This standard is issued under the fixed designation B 366; 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 B 16.11 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 ANSI B16.9, ANSI B16.11, ANSI 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 ANSI B16.9, B16.11, or B16.28.

1.1.2 Class CR fittings are those manufactured to the requirements of MSS SP-43, MSS SP-95 or MSS SP-97.

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 Strip[2]

B 160 Specification for Nickel Rod and Bar[2]

B 161 Specification for Nickel Seamless Pipe and Tube[2]

B 162 Specification for Nickel Plate, Sheet, and Strip[2]

B 164 Specification for Nickel-Copper Alloy Rod, Bar, and Wire[2]

B 165 Specification for Nickel-Copper Alloy (UNS N04400) Seamless Pipe and Tube[2]

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 Wire[2]

B 167 Specification for Nickel-Chromium-Iron Alloy (UNS N06600, N06601, and N06690) Seamless Pipe and Tube[2]

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 Strip[2]

B 333 Specification for Nickel-Molybdenum Alloy Plate, Sheet, and Strip[2]

B 335 Specification for Nickel-Molybdenum Alloy Rod[2]

B 407 Specification for Nickel-Iron-Chromium Alloy Seamless Pipe and Tube[2]

B 408 Specification for Nickel-Iron-Chromium Alloy Rod and Bar[2]

B 409 Specification for Nickel-Iron-Chromium Alloy Plate, Sheet, and Strip[2]

B 423 Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloy (UNS N08825 and N08221) Seamless Pipe and Tube[2]

B 424 Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825 and UNS N08221) Plate, Sheet, and Strip[2]

B 425 Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825 and UNS N08221) Rod and Bar[2]

B 434 Specification for Nickel-Molybdenum-Chromium-Iron Alloy (UNS N10003) Plate, Sheet, and Strip[2]

B 435 Specification for UNS N06002, UNS N06230, UNS N12160 and UNS R30556 Plate, Sheet, and Strip[2]

B 443 Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) Plate, Sheet, and Strip[2]

B 444 Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) Pipe and Tube[2]

B 446 Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) Rod and Bar[2]

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 Service[2]

B 463 Specification for UNS N08020, UNS N08026, and UNS N08024 Alloy Plate, Sheet, and Strip[2]

B 464 Specification for Welded UNS N08020, N08024, and N08026 Alloy Pipe[2]

B 468 Specification for Welded UNS N08020, N08024, and N08026 Alloy Tubes[2]

B 472 Specification for UNS N08020, UNS N08026, UNS N08024, UNS N08926, UNS N08367, and UNS R20033 Nickel Alloy Billets and Bars for Reforging[2]

B 473 Specification for UNS N08020, UNS N08026, and UNS N08024 Nickel Alloy Bar and Wire[2]

B 511 Specification for Nickel-Iron-Chromium-Silicon Alloy Bars and Shapes[2]

B 512 Specification for Nickel-Chromium-Silicon Alloy (UNS N08330) Billets and Bars[2]

B 514 Specification for Welded Nickel-Iron-Chromium Alloy Pipe[2]

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[1] This specification is under the jurisdiction of ASTM Committee B-2 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 Dec. 10, 1997. Published March 1998. Originally published as B 366 – 61. Last previous edition B 366 – 97.

[2] *Annual Book of ASTM Standards*, Vol 02.04.

B 515 Specification for Welded UNS N08800, UNS N08810, and UNS N08811 Alloy Tubes[2]
B 516 Specification for Welded Nickel-Chromium-Iron Alloy (UNS N06600), UNS N06025, and UNS N06045 Tubes[2]
B 517 Specification for Welded Nickel-Chromium-Iron Alloy (UNS N06600), UNS N06025, and UNS N06045 Pipe[2]
B 535 Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and UNS N08332) Seamless Pipe[2]
B 536 Specification for Nickel-Iron-Chromium-Silicon Alloys (UNS N08330 and N08332) Plate, Sheet, and Strip[2]
B 564 Specification for Nickel Alloy Forgings[2]
B 572 Specification for UNS N06002, UNS N06230, UNS N12160 and UNS R30556 Rod[2]
B 573 Specification for Nickel-Molybdenum-Chromium-Iron Alloy (UNS N10003) Rod[2]
B 574 Specification for Low-Carbon Nickel-Molybdenum-Chromium, Low-Carbon Nickel-Chromium-Molybdenum, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod[2]
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 Strip[2]
B 581 Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Rod[2]
B 582 Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip[2]
B 619 Specification for Welded Nickel and Nickel-Cobalt Alloy Pipe[2]
B 622 Specification for Seamless Nickel and Nickel-Cobalt Alloy Pipe and Tube[2]
B 625 Specification for UNS N08904, UNS N08925, UNS N08031, UNS N08932, UNS N08926, and UNS R20033 Plate, Sheet, and Strip[2]
B 626 Specification for Welded Nickel and Nickel-Cobalt Alloy Tube[2]
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 Wire[2]
B 673 Specification for UNS N08904, N08925, and N08926 Welded Pipe[2]
B 674 Specification for UNS N08904, N08925, and N08926 Welded Tube[2]
B 675 Specification for UNS N08366 and UNS N08367 Welded Pipe[2]
B 676 Specification for UNS N08366 and UNS N08367 Welded Tube[2]
B 677 Specification for UNS N08904, N08925, and N08926 Seamless Pipe and Tube[2]
B 688 Specification for Chromium-Nickel-Molybdenum-Iron (UNS N08366 and UNS N08367) Plate, Sheet, and Strip[2]
B 690 Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Seamless Pipe and Tube[2]
B 691 Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08366 and UNS N08367) Rod, Bar, and Wire[2]
B 704 Specification for Welded UNS N06625 and UNS N08825 Alloy Tubes[2]
B 705 Specification for Nickel-Alloy (UNS N06625 and N08825) Welded Pipe[2]
B 710 Specification for Nickel-Iron-Chromium-Silicon Alloy Welded Pipe[2]
E 165 Test Method for Liquid Penetrant Examination[3]

2.2 *ANSI Standards:*

B16.9 Wrought Steel Butt Welding Fittings[4]
B16.11 Forged Steel Fittings, Socket-Welding and Threaded[4]
B16.28 Wrought Steel Butt Welding Short Radius Elbows and Returns[4]
H34.1 Nickel Seamless Pipe and Tubing[4]
H34.2 Nickel-Copper Alloy Seamless Pipe and Tubing[4]
H34.3 Nickel-Chromium-Iron Alloy Seamless Pipe and Tubing[4]

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

MSS SP-25 Standard Marking Systems for Valves, Fittings, Flanges, and Unions[5]
MSS SP-43 Standard Practice for Light Weight Stainless Steel Butt Welding Fittings[5]
MSS SP-95 Swage (D) Nipples and Bull Plugs[5]
MSS SP-97 Forged Carbon Steel Branch Outlet Fittings—Socket Welding, Threaded and Butt Welding Ends[5]

2.4 *ASME Standards:*

Boiler and Pressure Vessel Code, Section VIII, Division 1, Pressure Vessels and Section IX, Welding Qualifications[6]

2.5 *AWS Standards:*

A5.11 Specification for Nickel and Nickel Alloy Covered Welding Electrodes[7]
A5.14 Specification for Nickel and Nickel-Alloy Bare Welding Rods and Electrodes[7]

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

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

[4] Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

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

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

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

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 ANSI 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 ANSI 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 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 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 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 A5.11 and A5.14.

6. Mechanical Properties and Other Requirements

6.1 *Tensile Requirements:*

6.1.1 Material used in the manufacture of the fittings shall conform to the requirements for tensile properties as prescribed for the respective product in Table 1.

6.1.2 Finished fittings shall conform to the properties for the respective material and temper as prescribed in the specifications referred to in Table 1. When required, the properties of fittings made from forging stock shall be as agreed upon between the producer and the purchaser.

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

6.2 *Hydrostatic Tests:*

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

6.2.2 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.

7. Dimensions

7.1 Fittings or components produced in accordance with

TABLE 1 Permissible Raw Materials

Marking[A]			Product and ASTM Designation[B]			
Corrosion-Resistant Fittings	ANSI Pressure Fittings	Alloy	UNS Designation	Pipe or Tube	Plate, Sheet, or Strip	Bar Forging and Forging Stock
CRN	WPN	Ni	N02200	B 161	B 162	B 160, B 564
CRNL	WPNL	Ni, low C	N02201	B 161	B 162	B 160
CRNC[C]	WPNC[C]	Ni-Cu	N04400	B 165	B 127	B 164, B 564
CR HX	WPHX	Ni-Cr-Mo-Fe	N06002	B 619, B 622, B 626	B 435	B 572
CR HG	WPHG	Ni-Cr-Fe-Mo-Cu	N06007	B 619, B 622, B 626	B 582	B 581
CR HC 22	WPHC22	Low C-Ni-Mo-Cr	N06022	B 619, B 622, B 626	B 575	B 574, B 564
CRV602	WPV602	Ni-Cr-Fe	N06025	B 163, B 167	B 168	B 166
CR HG 30	WPHG30	Ni-Cr-Fe-Mo-Cu	N06030	B 619, B 622, B 626	B 582	B 581
CRV45TM	WPV45TM	Ni-Cr-Fe	N06045	B 163, B 167	B 168	B 166
CR5923	WP5923	Low C-Ni-Cr-Mo	N06059	B 619, B 622, B 626	B 575	B 564, B 574
CR HC 2000	WPHC2000	Low C-Ni-Cr-Mo-Cu	N06200	B 619, B 622, B 626	B 575	B 574, B 564
CRH230	WPH230	Ni-Cr-W-Mo	N06230	B 619, B 622, B 626	B 435	B 572, B 564
CR HC 4	WPHC4	Low C-Ni-Mo-Cr	N06455	B 619, B 622, B 626	B 575	B 574
CRNCI	WPNCI	Ni-Cr-Fe	N06600	B 167, B 516, B 517	B 168	B 166, B 564
CR603GT	WP603GT	Ni-Cr-Fe-Al	N06603	B 163, B 167, B 516, B 517	B 168	B 166, B 564
CRNCMC	WPNCMC	Ni-Cr-Mo-Cb	N06625	B 444, B 704, B 705	B 443	B 446, B 564
CR HG3	WPHG3	Ni-Cr-Fe-Mo-Cu	N06985	B 619, B 622, B 626	B 582	B 581
CR20CB	WP20CB	Cr-Ni-Fe-Mo-Cu-Cb stabilized	N08020	B 464, B 468, B 729	B 463	B 472, B 473, B 462
CR904L	WP904L	Ni-Fe-Cr-Mo-Cu low C	N08904	B 673, B 674, B 677	B 625	B 649
CR3127	WP3127	Ni-Fe-Cr-Mo-Cu-Low Carbon	N08031	B 619, B 622, B 626	B 625	B 564, B 649
CRH120	WPH120	Ni-Cr-Fe	N08120	B 407, B 514, B 515	B 409	B 408, B 564
CR330	WP330	Ni-Fe-Cr-Si	N08330	B 535, B 710	B 536	B 511, B 512
CR6XN	WP6XN	Fe-Ni-Cr-Mo-N	N08367	B 675, B 676, B 690	B 688	B 472, B 564, B 691, B 462
CRNIC	WPNIC	Ni-Fe-Cr	N08800	B 407, B 514, B 515	B 409	B 408, B 564
CRNIC10	WPNIC10	Ni-Fe-Cr	N08810	B 407, B 514, B 515	B 409	B 408, B 564
CRNIC11	WPNIC11	Ni-Fe-Cr	N08811	B 407	B 409	B 408, B 564
CRNICMC	WPNICMC	Ni-Fe-Cr-Mo-Cu	N08825	B 423, B 704, B 705	B 424	B 425, B 564
CR1925	WP1925	Ni-Fe-Cr-Mo-Cu low C	N08925	B 673, B 674, B 677	B 625	B 649
CR1925N	WP1925N	Ni-Fe-Cr-Mo-Cu-N low C	N08926	B 673, B 674, B 677	B 625	B 649
CR HB	WPHB	Ni-Mo	N10001	B 619, B 622, B 626	B 333	B 335
CR HN	WPHN	Ni-Mo-Cr-Fe	N10003		B 434	B 573
CR HC 276	WPHC276	Low C-Ni-Mo-Cr	N10276	B 619, B 622, B 626	B 575	B 574, B 564
CRVB4	WPVB4	Ni-Mo	N10629	B 619, B 622, B 626	B 333	B 335
CR HB2	WPHB-2	Ni-Mo	N10665	B 619, B 622, B 626	B 333	B 335
CR HB3	WPHB-3	Ni-Mo	N10675	B 619, B 622, B 626	B 333	B 335, B 564
CRH160	WPH160	Ni-Co-Cr-Si	N12160	B 619, B 622, B 626	B 435	B 572, B 564
CR3033	WP3033	Cr-Ni-Fe-N Low Carbon	R20033	B 619, B 622, B 626	B 625	B 564, B 649, B 472
CRH556	WPH556	Ni-Fe-Cr-Co	R30556	B 619, B 622, B 626	B 435	B 572

[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 4.2.4.2 or 4.2.5.1 is used, the symbol shall be supplemented by WU or WXU as applicable.
[B] See 2.1 and 4.1.
[C] Yield strength shall be 25 000 psi (172 MPa) min, for all hot-formed, annealed fittings made from WPNC material.

this specification shall have sizes, shapes, and dimensions in accordance with those specified in ASME 16.9, ASME 16.11, ASME 16.28, MSS SP-43, MSS SP-95, MSS SP-97 ASME H34.1, ASME H34.2, or ASME H34.3.

8. Workmanship, Finish, and Appearance

8.1 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.

8.2 The fittings shall be cleaned free of scale.

9. Inspection

9.1 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.

10. Rejection and Rehearing

10.1 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.

11. Certification

11.1 When requested by the purchaser, the manufacturer shall report to the purchaser or his representative the results of the chemical analysis made in accordance with Section 5, the results of the tension tests specified in Section 6, or the use of ultrasonic examination in accordance with 4.2.4.2 or 4.2.5.1, or a combination thereof.

12. Product Marking

12.1 The manufacturer's name or trademark, material, the size and schedule number, the designation as shown in Table 1, under "Marking," either column 1 for class CR fittings or column 2 for class WP fittings, shall be stamped, stenciled, or otherwise permanently marked on each fitting. Class WP fitting marking also must include the suffix in accordance with 4.2. On wall thicknesses thinner than 0.083 in., no steel stamps or other indented markings shall be used. When the size does not permit complete marking, identifica-

tion marks may be omitted in the sequence shown in MSS SP-25.

NOTE—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.

13. Keywords

13.1 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 5.

S2. Tension Test (Note S2.1)

S2.1 One tension test shall be made on one fitting or representative test piece (Note S2.1) per lot (Note S2.3) of fittings. If the fittings are of welded construction, 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 1, 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 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 E 165. 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.

APPENDIX

(Nonmandatory Information)

X1. HEAT TREATMENT

X1.1 Proper heat treatment during or subsequent to fabrication may be necessary for optimum performance, and the manufacturer shall be consulted for details. The final heat treatment should be consistent with the heat treatment requirements given in the respective pipe or tube specifications.