Designation: B462 – 18ε1

Standard Specification for Forged or Rolled Nickel Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service [1]

This standard is issued under the fixed designation B462; 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.

ε[1] NOTE—Editorial corrections were made to Table 1 in January 2021.

1. Scope*

1.1 This specification[2] covers forged or rolled UNS N06030, UNS N06035, UNS N06022, 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 N06699, and UNS R20033[3] pipe flanges, forged fittings, and valves and parts intended for corrosive high-temperature service.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *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, health, and environmental practices, and determine the applicability of regulatory limitations prior to use.*

1.4 *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:*[4]

A262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

B166 Specification for Nickel-Chromium-Aluminum Alloy, Nickel-Chromium-Iron Alloys, Nickel-Chromium-Cobalt-Molybdenum Alloy, Nickel-Iron-Chromium-Tungsten Alloy, and Nickel-Chromium-Molybdenum-Copper Alloy Rod, Bar, and Wire

B335 Specification for Nickel-Molybdenum Alloy Rod

B408 Specification for Nickel-Iron-Chromium Alloy Rod and Bar

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

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

B581 Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Rod

B649 Specification for Ni-Fe-Cr-Mo-Cu-N Low-Carbon Alloys (UNS N08925, UNS N08031, UNS N08034, 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

B691 Specification for Iron-Nickel-Chromium-Molybdenum Alloys (UNS N08367) Rod, Bar, and Wire

B880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys

[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] For ASME Boiler and Pressure Vessel Code applications see related Specification SB-462 in Section II of that Code.

[3] New designation established in accordance with Practice E527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

[4] 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 Chemical Requirements

Element	UNS N08020	UNS N08367	UNS R20033
Carbon, max	0.07	0.030	0.015
Manganese, max	2.00	2.00	2.0
Phosphorus, max	0.045	0.040	0.02
Sulfur, max	0.035	0.030	0.01
Silicon, max	1.00	1.00	0.50
Nickel	32.00–38.00	23.50 to 25.50	30.0–33.0
Chromium	19.00–21.00	20.00 to 22.00	31.0–35.0
Molybdenum	2.00–3.00	6.00 to 7.00	0.50–2.0
Copper	3.00–4.00	0.75 max	0.30–1.20
Columbium (Nb) + tantalum	8 × carbon–1.00	...	...
Nitrogen	...	0.18 to 0.25	0.35–0.60
Iron	Remainder[A]	Remainder[A]	Remainder[A]

Element	Composition, %					
	UNS N06030	UNS N06022	UNS N06200	UNS N10276	UNS10665	UNS N10675
Carbon, max	0.03	0.015	0.010	0.010	0.02	0.01
Manganese, max	1.5	0.50	0.50	1.0	1.0	3.0
Phosphorous, max	0.04	0.02	0.025	0.04	0.04	0.030
Sulphur, max	0.02	0.02	0.010	0.03	0.03	0.010
Silicon. max	0.8	0.08	0.08	0.08	0.10	0.10
Nickel	Remainder[A]	Remainder[A]	Remainder[A]	Remainder[A]	Remainder[A]	Remainder[A]
Chromium	28.0-31.5	20.0-22.5	22.0–24.0	14.5-16.5	1.0 max	1.0-3.0
Molybdenum	4.0-6.0	12.5-14.5	15.0-17.0	15.0-17.0	26.0-30.0	27.0-32.0
Copper	1.0-2.4	...	0.3-1.9	...	...	0.20
Columbium (Nb) + tantalum	0.30-1.50	...	...	...	...	...
Nitrogen	...	...	...	...	...	...
Iron	13.0-17.0	2.0-6.0	3.0 max	4.0-7.0	2.0 max	1.0-3.0
Cobalt, max	5.0	2.5	2.0	2.5	1.0	3.0
Tungsten	1.5-4.0	2.5-3.5	...	3.0-4.5	...	3.0 max
Vanadium, max	...	0.35	...	0.35	...	0.20
Titanium, max	...	...	...	...	...	0.2
Zirconium, max	...	...	...	...	...	0.10
Columbium (Nb)	...	...	...	...	...	0.20 max
Tantalum	...	...	...	...	...	0.20 max
Nickel + Molybdenum	...	...	...	...	...	94.0-98.0
Aluminum, max	...	...	0.50	...	...	0.50

Element	Composition, %								
	UNS N06699	UNS N06059	UNS N10362	UNS N06686	UNS N08031	UNS N06045	UNS† N06025	UNS† N10629	UNS† N06035
Carbon, max	0.005-0.10	0.010	0.010	0.010	0.015	0.05-0.12	0.15-0.25	0.01	0.050
Manganese, max	0.50	0.5	0.60	0.75	2.0	1.0	0.15	1.5	0.50
Phosphorous, max	0.02	0.015	0.025	0.04	0.020	0.02	0.02	0.040	0.030
Sulphur, max	0.01	0.010	0.010	0.02	0.010	0.010	0.010	0.010	0.015
Silicon, max	0.50	0.10	0.08	0.08	0.3	2.5-3.0	0.5	0.05	0.60
Nickel,	Remainder[A]	Remainder[A]	Remainder[A]	Remainder[A]	30.0-32.0	45.0 min	Remainder[A]	Remainder[A]	Remainder[A]
Chromium	26.0-30.0	22.0-24.0	13.8-15.6	19.0-23.0	26.0-28.0	26.0-29.0	24.0-26.0	0.5-1.5	32.25-34.25
Molybdenum	...	15.0-16.5	21.5-23.0	15.0-17.0	6.0-7.0	...	...	26.0-30.0	7.60-9.00
Copper	0.50 max	0.50 max	...	...	1.0-1.4	0.3 max	0.1 max	0.5	0.30 max
Yttrium	...	...	...	...	...	...	0.05-0.12	...	...
Nitrogen	0.05 max	...	...	...	0.15-0.25	...	...	...	...
Iron	2.5 max	1.5 max	1.25 max	5.0 max	Remainder[A]	21.0-25.0	8.0–11.0	1.0-6.0	2.00 max
Cobalt, max	...	0.3	...	...	...	...	...	2.5	1.00
Tungsten	...	...	...	3.0-4.4	...	...	...	...	0.60 max
Vanadium, max	...	...	...	...	...	...	...	...	0.20
Titanium, max	0.60	...	...	0.02-0.25	...	...	0.1-0.2	...	...
Zirconium, max	0.10	...	...	...	...	...	0.01-0.10	...	...
Columbium (Nb)	0.50 max	...	...	...	...	...	...	...	...
Tantalum	...	...	...	...	...	...	...	...	...
Cerium	...	...	...	...	...	0.03-0.09	...	...	...
Aluminum, max	1.9-3.0	0.1-0.4	0.50	...	...	...	1.8-2.4	0.1-1.5	0.40
Boron	0.008 max	...	...	...	...	...	...	...	...

[A] Shall be determined arithmetically by difference.
† Editorially corrected.

E8/E8M Test Methods for Tension Testing of Metallic Materials

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

E1473 Test Methods for Chemical Analysis of Nickel, Cobalt and High-Temperature Alloys
E1916 Guide for Identification of Mixed Lots of Metals

2.2 *ANSI Standard:*
B16.5 Steel Pipe Flanges and Flanged Fittings (for applicable alloy UNS N08020)[5]

2.3 *Manufacturers' Standardization Society of the Valve and Fittings Industry Standard:*
SP-25 Standard Marking System for Valves, Fittings, Flanges, and Unions[6]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *forgings, n*—the term forgings as used in this specification shall be understood to cover one or all of the products mentioned in 1.1, either forged or rolled.

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 (weight or number of pieces),
4.1.2 Name of material or UNS number,
4.1.3 Forging sketch when required (5.2.4),
4.1.4 Forging sectioning, if required (5.2.3),
4.1.5 ASTM designation and year of issue,
4.1.6 Inspection (14.1),
4.1.7 Supplementary requirements, if any, and
4.1.8 If possible, the intended end use.

NOTE 1—A typical ordering description is as follows: 200 forgings, UNS N08020, in accordance with the attached drawing and Specification B462.

5. Materials and Manufacture

5.1 *Discard*—A sufficient discard shall be made from each ingot to secure freedom from injurious piping and undue segregation. The material shall have a homogeneous structure as shown by the macroetch test in 7.3.

5.2 *Manufacturing Practice:*

5.2.1 Material for forging shall consist of a billet, bar, or forging produced in accordance with Specifications B166, B335, B408, B462, B472, B473, B574, B581, B649, or B691.

5.2.2 The material shall be forged by hammering, pressing, rolling, extruding, or upsetting; it shall be brought as nearly as practicable to the finished shape and size by hot working; and shall be so processed as to cause metal flow during the hot-working operation in the direction most favorable for resisting the stresses encountered in service.

5.2.3 When specified in the order, a sample forging may be sectioned and etched to show flow lines and the condition as regards internal imperfections. In such cases, the question of acceptable and unacceptable character of metal flow shall be a subject for agreement between the manufacturer and the purchaser.

5.2.4 When specified in the order, the manufacturer shall submit for approval of the purchaser a sketch showing the shape of the rough forging before machining.

5.3 *Heat Treatment:*

5.3.1 The product of UNS N08020 alloy shall be furnished in the stabilized-annealed condition. The product of UNS N06022, UNS N06035, UNS N06030, UNS N06200, UNS N10362, UNS N10276, UNS N10665, UNS N10675, UNS N06699, and UNS R20033 alloys shall be furnished in the solution annealed condition.

NOTE 2—The recommended annealing temperatures all followed by water quenching or rapidly cooling by other means are: UNS N06030–2125 to 2175°F (1163 to 1191°C), UNS N06022–2025 to 2075°F (1107 to 1135°C), UNS N06035–2025–2075°F (1107–1135°C), UNS N06200–2075 to 2125°F (1135 to 1163°C), UNS N06059–2025 to 2125°F (1107 to 1163°C), UNS N10362–2075 to 2125°F (1135 to 1163°C), UNS N06686–2125 to 2225°F (1163 to 1218°C), UNS N08020–1700 to 1850°F (927 to 1010°C), UNS N10276–2025 to 2075°F (1107 to 1135°C), UNS N10665–1925 to 2000°F (1052 to 1093°C), UNS N10675–1925 to 2000°F (1052 to 1093°C), UNS N10629–1925 to 2000°F (1052 to 1093°C), UNS N08031–2050 to 2160°F (1121 to 1182°C) UNS N06045–2125 to 2190°F (1163 to 1199°C), UNS N06025–2175 to 2240°F (1191 to 1227°C), UNS N06699–1975 to 2065°F (1080 to 1130°C), and UNS R20033–2010 to 2150°F (1100 to 1180°C).

5.3.2 Alloy N08367 shall be furnished in the solution annealed condition.

5.3.2.1 The recommended heat treatment shall consist of heating to a minimum temperature of 2025°F (1105°C) and quenching in water, or rapidly cooling, by other means.

5.3.3 Heat treatment may be performed before machining.

6. Chemical Composition

6.1 The material shall conform to the requirements as to chemical composition prescribed in Table 1.

[5] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[6] 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.