



Designation: ~~B572–06 (Reapproved 2016)~~ B572 – 24

## Standard Specification for ~~UNS N06002, UNS N06230, UNS N12160, and UNS R30556~~ Heat and Corrosion Resistant High Temperature Alloy Bar or Rod<sup>1</sup>

This standard is issued under the fixed designation B572; 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 ~~Scope\*~~

1.1 This specification<sup>2</sup> covers ~~alloys UNS N06002, UNS N06230, UNS N12160, and UNS R30556~~ alloys in the form of bar or rod that are typically used ~~in the form of rod for heat~~ for (though not limited to) heat resisting and general-corrosive service.

1.2 ~~The following products are covered under this specification:~~ Alloys that can currently be certified to this specification are UNS N06002, UNS N06230, UNS N12160, and UNS R30556.

1.2.1 Rods  $\frac{5}{16}$  to  $\frac{3}{4}$  in. (7.94 to 19.05 mm) exclusive in diameter, hot or cold finished, solution-annealed, and pickled or mechanically descaled.

1.2.2 Rods  $\frac{3}{4}$  to  $3\frac{1}{2}$  in. (19.05 to 88.9 mm) inclusive in diameter, hot or cold finished, solution-annealed, ground, or turned.

1.3 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.

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

1.5 *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:<sup>3</sup>

[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](#)

[E8E8/E8M Test Methods for Tension Testing of Metallic Materials](#) ~~[Metric]~~ ~~E0008~~ ~~E0008M~~

<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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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications see related Specification SB-572 in Section II of that Code.

<sup>3</sup> 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

[E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications](#)  
[E55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition](#)  
~~[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](#)

### 3. Terminology

3.1 Common B02.07 terminology is found in Specification [B899](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bar, n*—an elongated, forged or rolled metal product with uniform strength, length, and diameter.

3.2.2 *rod, n*—a hot-finished product of round solid section furnished in straight lengths.

### 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.

~~4.2 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:~~

4.2.1 *Alloy*,

4.2.2 *Dimensions*—Nominal diameter (Section ~~8~~) and length. The shortest useable multiple length should be specified (~~Table 1~~),

~~4.1.3 Certification~~—State if certification or a report of test results is required (Section ~~16~~).

4.2.3 *Purchaser Inspection*—State which tests or inspections are to be witnessed (Section ~~13~~), and

4.2.4 *Samples for Product (Check) Analysis*—State whether samples should be furnished ((Section ~~9.2.2.10~~)).

### 5. Materials and Manufacture

5.1 The finish options for products certified to this specification are:

5.1.1 Hot-Finished, Annealed, and Descaled Rod,

5.1.2 Hot-Finished, Annealed, and Ground Bar,

5.1.3 Hot-Finished, Annealed, and Turned Bar,

5.1.4 Cold-Finished and Annealed Bar, and

5.1.5 Cold-Finished, Annealed, and Ground Bar.

5.2 The diameters permitted for certification for each finish appear in the left column of [Table 3](#).

### 6. Chemical Composition

6.1 The material shall conform to the requirements as to chemical composition prescribed in [Table 21](#).

6.2 If a product (check) analysis is made by the purchaser, ~~the material shall conform to the requirements specified~~ it shall be done in [Table 2](#) subject to the permissible tolerances in Specification conformance with Specification [B880](#).

**TABLE 21 Chemical Requirements<sup>A</sup>**

Element	Composition Limits, %			
	UNS N06002	UNS N06230	UNS N12160	UNS R30556
Nickel	remainder <sup>A</sup>	remainder <sup>A</sup>	remainder <sup>A</sup>	19.0–22.5
Nickel	remainder <sup>B</sup>	remainder <sup>B</sup>	remainder <sup>B</sup>	19.0–22.5
Iron	17.0–20.0	3.0	3.5	remainder <sup>A</sup>
Iron	17.0–20.0	3.0	3.5	remainder <sup>B</sup>
Chromium	20.5–23.0	20.0–24.0	26.0–30.0	21.0–23.0
Cobalt	0.5–2.5	5.0 max	27.0–33.0	16.0–21.0
Cobalt	0.5–2.5	5.0	27.0–33.0	16.0–21.0
Molybdenum	8.0–10.0	1.0–3.00	1.0 max	2.5–4.0
Molybdenum	8.0–10.0	1.0–3.00	1.0	2.5–4.0
Tungsten	0.2–1.0	13.0–15.0	1.0	2.0–3.5
Tungsten	0.2–1.0	13.0–15.0	1.0	2.0–3.5
Carbon	0.05–0.15	0.05–0.15	0.15 max	0.05–0.15
Carbon	0.05–0.15	0.05–0.15	0.15	0.05–0.15
Silicon	1.00 max	0.25–0.75	2.4–3.0	0.20–0.80
Silicon	1.00	0.25–0.75	2.4–3.0	0.20–0.80
Manganese	1.00 max	0.30–1.00	1.5 max	0.50–2.00
Manganese	1.00	0.30–1.00	1.5	0.50–2.00
Phosphorus	0.04	0.030 max	0.030 max	0.04 max
Phosphorus	0.04	0.030	0.030	0.04
Sulfur	0.03	0.015 max	0.015 max	0.015 max
Sulfur	0.03	0.015	0.015	0.015
Columbium	...	...	1.0 max	0.30 max
Niobium <sup>C</sup>	...	...	1.0	0.30
Tantalum	...	...	...	0.30–1.25
Aluminum	...	0.50 max	...	0.10–0.50
Aluminum	...	0.50	...	0.10–0.50
Zirconium	...	...	...	0.001–0.10
Lanthanum	...	0.005–0.050	...	0.005–0.10
Nitrogen	...	...	...	0.10–0.30
Boron	...	0.015 max	...	0.02 max
Boron	...	0.015	...	0.02
Titanium	...	...	0.20–0.80	...

<sup>A</sup> See 12.1.1. Values in the table are maximums unless a range or minimum is indicated.  
<sup>B</sup> The composition of the remainder element shall be determined arithmetically by difference.  
<sup>C</sup> Columbium and Niobium are interchangeable names for the same element and both names are acceptable for use in B02.07 specifications.

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**7. Mechanical and Other Requirements**

7.1 The mechanical properties of the material at room temperature shall conform to those shown in Table 32.

7.2 *Grain Size*—Annealed alloy (UNS N12160) shall conform to an average grain size of ASTM Number 5 or coarser.

**8. Dimensions, Mass, and Permissible Variations**

8.1 *Diameter*—The permissible variations from the specified diameter shall be as prescribed in Table 43.

**TABLE 32 Mechanical Property Requirements**

UNS	Tensile Strength, min, ksi (MPa)	Yield Strength (0.2 % Offset), min, ksi (MPa)	Elongation in 2 in. (50.8mm) or 4D <sup>A</sup> min, %
N06002	95 (660)	35 (240)	35
N06230 <sup>B</sup>	110 (760)	45 (310)	40
N12160 <sup>C</sup>	90 (620)	35 (240)	40
R30556 <sup>D</sup>	100 (690)	45 (310)	40

<sup>A</sup> D refers to the diameter of the tension specimen.  
<sup>B</sup> Solution annealed at a temperature between 2200 to 2275°F (1204 to 1246°C) 2200 °F to 2275 °F (1204 °C to 1246 °C) followed by a water quench or rapidly cooled by other means.  
<sup>C</sup> Solution annealed at 1950°F (1065°C) 1950 °F (1065 °C) minimum.  
<sup>D</sup> Solution annealed at 2400°F (1315°C) 2100 °F (1150 °C) minimum.

**TABLE 4 Permissible Variations in Diameter and Out-of-Roundness of Finished Rods**

Specified Diameter, in. (mm)	Permissible Variations, in. (mm)		
	Diameter		Out of Roundness, max
	+	-	
<b>Hot-Finished, Annealed, and Descaled Rods</b>			
$\frac{5}{16}$ to $\frac{7}{16}$ (7.94–11.11), incl	0.012 (0.30)	0.012 (0.30)	0.018 (0.46)
Over $\frac{7}{16}$ to $\frac{5}{8}$ (11.11–15.87), incl	0.014 (0.36)	0.014 (0.36)	0.020 (0.51)
Over $\frac{5}{8}$ to $\frac{3}{4}$ (15.87–19.05), excl	0.016 (0.41)	0.016 (0.41)	0.024 (0.61)
<b>Hot-Finished, Annealed, and Ground or Turned Rods</b>			
$\frac{5}{16}$ to $\frac{3}{8}$ (19.05–88.9), incl	0.010 (0.25)	0	0.008 (0.20)

**TABLE 3 Permissible Variations in Diameter and Out-of-Roundness Products**

Specified Diameter, in. (mm)	Permissible Variations, in. (mm)		
	Diameter		Out of Roundness, max
	+	-	
<b>Hot-Finished, Annealed, and Descaled Rod</b>			
$\frac{5}{16}$ to $\frac{7}{16}$ (7.94 to 11.11), incl	0.012 (0.30)	0.012 (0.30)	0.018 (0.46)
Over $\frac{7}{16}$ to $\frac{5}{8}$ (11.11 to 15.87), incl	0.014 (0.36)	0.014 (0.36)	0.020 (0.51)
Over $\frac{5}{8}$ to 1.0 (15.87 to 25.4), incl	0.016 (0.41)	0.016 (0.41)	0.024 (0.61)
Over 1.0 to 2.0 (25.4 to 50.8), incl	0.031 (0.79)	0.016 (0.41)	0.035 (0.89)
Over 2.0 to 3 $\frac{5}{8}$ (50.8 to 92.08), excl	0.047 (1.19)	0.031 (0.79)	0.058 (1.47)
<b>Hot-Finished, Annealed, and Ground Bar</b>			
$\frac{5}{16}$ to $\frac{3}{8}$ (7.94 to 92.08), incl	0.010 (0.25)	0	0.008 (0.20)
Over $\frac{3}{8}$ to 9.0 (92.08 to 228.6), excl	0.050 (1.27)	0	...
<b>Hot-Finished, Annealed, and Turned Bar</b>			
$\frac{3}{8}$ to 9.0 (92.08 to 228.6)	0.125 (3.18)	0	...
<b>Cold-Finished, Annealed Bar</b>			
$\frac{1}{8}$ to $\frac{3}{4}$ (3.18 to 19.05)	0.010 (0.25)	0	0.008 (0.20)
<b>Cold-Finished, Annealed, and Ground Bar</b>			
$\frac{1}{8}$ to $\frac{3}{4}$ (3.18 to 19.05)	0.002 (0.05)	0.002 (0.05)	0.002 (0.05)

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8.2 *Out-of-Roundness*—The permissible variation in roundness shall be as prescribed in [Table 43](#).

8.3 *Machining Allowances*—When the surfaces of finished material are to be machined, the following allowances are suggested for normal machining operations:

8.3.1 *As-finished* (Annealed and Descaled)—For diameters of  $\frac{5}{16}$  in. to  $\frac{1}{16}$  in. (7.94(7.94 mm) to 17.46 mm) inclusive, an allowance of  $\frac{1}{16}$  in. (1.59 mm) ~~on the diameter should be made for~~ should be added on the diameter for finish machining.

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8.4 *Length*:

8.4.1 Unless multiple, nominal, or cut lengths are specified, random mill lengths shall be furnished.

8.4.2 The permissible variations in length of multiple, nominal, or cut length rod shall be as prescribed in [Table 14](#). Where rods are ordered in multiple lengths, a  $\frac{1}{4}$ -in. (6.35-mm) in. (6.35 mm) length addition shall be allowed for each uncut multiple length.

8.5 *Ends*:

8.5.1 Rods or bars ordered to random or nominal lengths shall be furnished with either cropped or sawed ends.

8.5.2 Rods or bars ordered to cut lengths shall be furnished with square saw cut or machined ends.

8.6 *Weight*—For calculations of mass or weight, the following densities shall be used:

Alloy	Density	
	lb/in. <sup>3</sup>	(g/cm <sup>3</sup> )
N06002	0.297	(8.23)
N06230	0.324	(8.97)
N12160	0.292	(8.08)
R30556	0.297	(8.23)

8.7 *Straightness*—The maximum curvature (depth of chord) shall not exceed 0.050 in. ~~multiplied by the length of the chord in feet~~