



Designation: B 572 – 03

## Standard Specification for UNS N06002, UNS N06230, UNS N12160, and UNS R30556 Rod<sup>1</sup>

This standard is issued under the fixed designation B 572; 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<sup>2</sup> covers alloys UNS N06002, UNS N06230, UNS N12160, and UNS R30556\* in the form of rod for heat resisting and general-corrosive service.

1.2 The following products are covered under this specification:

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 the standard. The values given in parentheses are for information only.

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 Material Safety Data Sheet 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:

B 880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys<sup>3</sup>

E 8 Test Methods for Tension Testing of Metallic Materials<sup>4</sup>

E 29 Practice for Using Significant Digits in Test Data to

Determine Conformance with Specifications<sup>5</sup>

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition<sup>6</sup>

E 1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys<sup>6</sup>

### 3. Terminology

#### 3.1 Definitions of Terms Specific to This Standard:

3.1.1 *rod*—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. Examples of such requirements include, but are not limited to the following:

4.1.1 *Alloy*.

4.1.2 *Dimensions*—Nominal diameter 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).

4.1.4 *Purchaser Inspection*—State which tests or inspections are to be witnessed (Section 13).

4.1.5 *Samples for Product (Check) Analysis*—State whether samples should be furnished (9.2.2).

### 5. Chemical Composition

5.1 The material shall conform to the requirements as to chemical composition prescribed in Table 2.

5.2 If a product (check) analysis is made by the purchaser, the material shall conform to the requirements specified in Table 2 subject to the permissible tolerances in Specification B 880.

### 6. Mechanical and Other Requirements

6.1 The mechanical properties of the material at room temperature shall conform to those shown in Table 3.

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

<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.

\* New designation established in accordance with ASTM E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 02.04.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 03.01.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 14.02.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 03.05.

**TABLE 1 Permissible Variations in Length of Rods**

Random mill lengths	2 to 12 ft (610 to 3660 mm) long with not more than 25 weight % under 4 ft (1.22 m).
Multiple lengths	Furnished in multiples of a specified unit length, within the length limits indicated above. For each multiple, an allowance of ¼ in. (6.35 mm) shall be made for cutting, unless otherwise specified. At the manufacturer's option, individual specified unit lengths may be furnished.
Nominal lengths	Specified nominal lengths having a range of not less than 2 ft (610 mm) with no short lengths allowed.
Cut lengths	A specified length to which all rods shall be cut with a permissible variation of + ⅛ in. (3.17 mm) – 0.

**TABLE 2 Chemical Requirements**

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
Iron	17.0–20.0	3.0 max	3.5 max	remainder <sup>A</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
Molybdenum	8.0–10.0	1.0–3.00	1.0 max	2.5–4.0
Tungsten	0.2–1.0	13.0–15.0	1.0 max	2.0–3.5
Carbon	0.05–0.15	0.05–0.15	0.15 max	0.05–0.15
Silicon	1.00 max	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
Phosphorus	0.04	0.030 max	0.030 max	0.04 max
Sulfur	0.03	0.015 max	0.015 max	0.015 max
Columbium	...	...	1.0 max	0.30 max
Tantalum	...	...	...	0.30–1.25
Aluminum	...	0.20–0.50	...	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
Titanium	...	...	0.20–0.80	...

<sup>A</sup> See 12.1.1.

**TABLE 3 Mechanical Property Requirements**

UNS	Tensile Strength, min, ksi (MPa)	Yield Strength (0.2 % Offset), min, ksi (MPa)	Elongation in 2 in. (50.8 mm) 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) followed by a water quench or rapidly cooled by other means.

<sup>C</sup> Solution annealed at 1950°F (1065°C) minimum.

<sup>D</sup> Solution annealed at 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
	+	–	
Hot-Finished, Annealed, and Descaled Rods			
⅝ to ⅞ (7.94–11.11), incl	0.012 (0.30)	0.012 (0.30)	0.018 (0.46)
Over ⅞ to 1 (11.11–15.87), incl	0.014 (0.36)	0.014 (0.36)	0.020 (0.51)
Over 1 to 1¼ (15.87–19.05), excl	0.016 (0.41)	0.016 (0.41)	0.024 (0.61)
Hot-Finished, Annealed, and Ground or Turned Rods			
¾ to 1½ (19.05–88.9), incl	0.010 (0.25)	0	0.008 (0.20)

## 7. Dimensions, Mass, and Permissible Variations

7.1 *Diameter*—The permissible variations from the specified diameter shall be as prescribed in Table 4.

7.2 *Out-of-Roundness*—The permissible variation in roundness shall be as prescribed in Table 4.

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

7.3.1 *As-finished* (Annealed and Descaled)—For diameters of ⅝ to 1⅛ in. (7.94 to 17.46 mm) inclusive, an allowance of ⅛ in. (1.59 mm) on the diameter should be made for finish machining.

7.4 *Length*:

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

7.4.2 The permissible variations in length of multiple, nominal, or cut length rod shall be as prescribed in Table 1. Where rods are ordered in multiple lengths, a ¼ -in. (6.35-mm) length addition shall be allowed for each uncut multiple length.

7.5 *Ends*:

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

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

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

Alloy	Density lb/in. <sup>3</sup>	Density (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)

7.7 *Straightness*—The maximum curvature (depth of chord) shall not exceed 0.050 in. multiplied by the length of the chord in feet (0.04 mm multiplied by the length in centimetres).

## 8. Workmanship, Finish, and Appearance

8.1 The material shall be uniform in quality and condition, smooth, and free of injurious defects.

## 9. Sampling

9.1 *Lots for Chemical Analysis and Mechanical Testing*:

9.1.1 A lot for chemical analysis shall consist of one heat.

9.1.2 A lot of bar for mechanical testing shall be defined as the material from one heat in the same condition and specified diameter.

9.2 *Sampling for Chemical Analysis*: