

# ASTM B160 / ASME SB 160

## SPECIFICATION FOR NICKEL ROD AND BAR

This specification covers nickel (UNS N02200), low carbon nickel (UNS N02201), and solution strengthened nickel (UNS N02211) in the form of hot-worked and cold-worked rod and bar.

### A. Chemical Composition :-

The material shall conform to the composition limits specified in Table 1.

**Table 1**

Element	Nickel (UNS N02200)	Low-Carbon Nickel (UNS N02201)	Solution Strengthened Nickel (UNS N02211)
Nickel, min <sup>A</sup>	99	99	93.7
Copper, max	0.25	0.25	0.25
Iron, max.	0.4	0.4	0.75
Manganese, max.	0.35	0.35	4.25–5.25
Carbon, max.	0.15	0.02	0.02
Silicon, max.	0.35	0.35	0.15
Sulfur, max.	0.01	0.01	0.015

<sup>A</sup> Element shall be determined arithmetically by difference.

### B. Mechanical Properties :-

The material shall conform to the mechanical properties specified in Table 2.

**Table 2**

Condition and Diameter or Distance Between Parallel Surfaces, in. (mm)	Tensile Strength, min, psi (MPa)	Yield Strength (0.2% offset), min, psi (MPa) <sup>A</sup>	Elongation in 2 in. or 50 mm or 4D, min %
Nickel (UNS N02200)			
Cold-worked (as worked):			
Rounds, 1 (25.4) and under	80 000 (550)	60 000 (415)	10 <sup>B</sup>
Rounds over 1 to 4 (25.4 to 101.6) incl.	75 000 (515)	50 000 (345)	15
Squares, hexagons, and rectangles, all sizes	65 000 (450)	40 000 (275)	25 <sup>B</sup>
Hot-worked:			
All sections, all sizes	60 000 (415)	15 000 (105)	35 <sup>C</sup>
Rings and disks <sup>D</sup>	–	–	–
Annealed:			
Rods and bars, all sizes	55 000 (380)	15 000 (105)	40 <sup>B</sup>
Rings and disks <sup>E</sup>	–	–	–
Forging quality:			
All sizes	F	F	F
Low-Carbon Nickel (UNS N02201) and Solution Strengthened Nickel (UNS N02211)			
Hot-worked:			
All sections, all sizes	50 000 (345)	10 000 (70)	40 <sup>C</sup>
Annealed:			
All products, all sizes	50 000 (345)	10 000 (70)	40 <sup>B</sup>

<sup>A</sup> See point D.2.

<sup>B</sup> Not applicable to diameters or cross sections under 3/32 in. (2.4 mm).

<sup>C</sup> For hot-worked flats 5/16 in. (7.9 mm) and under in thickness the elongation shall be 25%, min.

<sup>D</sup> Hardness B 45 to B 80, or equivalent.

<sup>E</sup> Hardness B 45 to B 70 or equivalent.

<sup>F</sup> Forging quality is furnished to chemical requirements and surface inspection only. No tensile properties are required.

### C. Length :-

The permissible variations in length of cold-worked and hot-worked rod and bar shall be as prescribed in Table 3.

Random mill lengths:	
Hot-worked	6 to 24 ft (1.83 to 7.31 m) long with not more than 25 weight % between 6 and 9 ft (1.83 and 2.74 m) <sup>A</sup>
Cold-worked	6 to 20 ft (1.83 to 6.1 m) long with not more than 25 weight % between 6 and 10 ft (1.83 and 3.05 m).
Multiple lengths	Furnished in multiples of a specified unit length, within the length limits indicated above. For each multiple, an allowance of 1/4 in. (6.4 mm) will 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. <sup>B</sup>
Cut lengths	A specified length to which all rods and bars will be cut with a permissible variation of + 1/8 in. (3.2 mm), - 0

<sup>A</sup> For hot-worked sections weighing over 25 lb/ft (37 kg/m) and for smooth forged products, all sections, short lengths down to 2 ft (610 mm) may be furnished.

<sup>B</sup> For cold-worked rods and bars under 1/2 in. (12.7 mm) in diameter or distance between parallel surfaces ordered to nominal or stock lengths with a 2 ft (610 mm) range, at least 93% of such material shall be within the range specified; the balance may be in shorter lengths, but in no case shall lengths less than 4 ft (1220 mm) be furnished.

### D. Test Methods :-

1. The chemical composition, mechanical, and other properties of the material as enumerated in this specification shall be determined, in case of disagreement, in accordance with the following methods:

Test	ASTM Designation
Chemical Analysis	E 1473
Tension	E 8
Rockwell Hardness	E 18
Hardness Conversion	E 140
Rounding Procedure	E 29

2. For purposes of determining compliance with the specified limits for requirements of the properties listed in the following table, an observed value or a calculated value shall be rounded as indicated below, in accordance with the rounding method of Practice E29:

Test	Rounded Unit for Observed or Calculated Value
Chemical composition, hardness, and tolerances (when expressed in decimals)	Nearest unit in the last right-hand place of figures of the specified limit. If two choices are possible, as when the digits dropped are exactly a 5, or a 5 followed only by zeros, choose the one ending in an even digit, with zero defined as an even digit.
Tensile strength and yield strength	Nearest 1000 psi (6.9 MPa)
Elongation	Nearest 1%

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