



Designation: B 408 – 01

Standard Specification for Nickel-Iron-Chromium Alloy Rod and Bar¹

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1. Scope

1.1 This specification² covers UNS N08120, UNS N08800, UNS N08810, UNS N08811*, and UNS N08890 in the form of hot-worked and cold-worked rod and bar. Alloy UNS N08800 is normally employed in service temperatures up to and including 1100°F (593°C). Alloys UNS N08120, UNS N08810, UNS N08811, and UNS N08890 are normally employed in service temperatures above 1100°F (593°C) where resistance to creep and rupture is required, and they are annealed to develop controlled grain size for optimum properties in this temperature range.

1.2 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 880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys, and Cobalt Alloys³
- E 8 Test Methods for Tension Testing of Metallic Materials⁴
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁵
- E 112 Test Methods for Determining the Average Grain Size⁴
- E 1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys⁶

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

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-408 in Section II of that Code.

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

³ Annual Book of ASTM Standards, Vol 02.04.

⁴ Annual Book of ASTM Standards, Vol 03.01.

⁵ Annual Book of ASTM Standards, Vol 14.02.

⁶ Annual Book of ASTM Standards, Vol 03.05.

3.1.1 *bar*—material of rectangular (flats), hexagonal, or square solid section up to and including 10 in. (254 mm) in width and 1/8 in. (3.2 mm) and over in thickness in straight lengths.

3.1.1.1 *Discussion*—Hot-worked rectangular bar in widths 10 in. (254 mm) and under may be furnished as hot-rolled plate with sheared or cut edges in accordance with Specification B 408, provided the mechanical property requirements of Specification B 408 are met.

3.1.2 *rod*—material of round solid section furnished in straight lengths.

4. Ordering Information

4.1 Orders for material to this specification should include information with respect to the following:

4.1.1 ASTM designation, and year of issue.

4.1.2 Alloy designation or UNS number.

4.1.3 *Section*—Rod (round) or bar (square, hexagonal, or rectangular).

4.1.4 *Dimensions*—Dimensions including length (Section 8, Tables 1-4 incl).

4.1.5 *Condition* (Table 5 and Appendix Appendix X1).

4.1.6 *Finish* (Appendix X1).

4.1.7 *Quantity* (feet or number of pieces).

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

4.1.9 *Samples for Product (Check) Analysis*—State whether samples for product (check) analysis should be furnished.

4.1.10 *Purchaser Inspection*—If purchaser wishes to witness tests or inspection of material at place of manufacture, the purchase order must so state indicating which test or inspections are to be witnessed.

5. Materials and Manufacture

5.1 *Heat Treatment*—The final heat treatment of UNS N08120 shall be 2150°F (1177°C) minimum, UNS N08810, 2050°F (1121°C) minimum, UNS N08811, and UNS N08890, 2100°F (1149°C) minimum.

6. Chemical Composition

6.1 The material shall conform to the composition limits specified in Table 6.

TABLE 1 Permissible Variations in Diameter or Distance Between Parallel Surfaces of Cold-Worked Rod and Bar

Specified Dimension, in. (mm) ^A	Permissible Variations from Specified Dimension, in. (mm)	
	+	-
Rounds:		
1 / 16 (1.6) to 3 / 16 (4.8), excl	0	0.002 (0.05)
3 / 16 (4.8) to 1 / 2 (12.7), excl	0	0.003 (0.08)
1 / 2 (12.7) to 15 / 16 (23.8), incl	0.001 (0.03)	0.002 (0.05)
Over 15 / 16 (23.8) to 1 15 / 16 (49.2), incl	0.0015 (0.04)	0.003 (0.08)
Over 1 15 / 16 (49.2) to 2 1 / 2 (63.5), incl	0.002 (0.05)	0.004 (0.10)
Hexagons, squares, rectangles:		
1 / 2 (12.7) and less	0	0.004 (0.10)
Over 1 / 2 (12.7) to 7 / 8 (22.2), incl	0	0.005 (0.13)
Over 7 / 8 (22.2) to 1 1 / 4 (31.8), incl	0	0.007 (0.18)
Over 1 1 / 4 (31.8) to 2 (50.8), incl	0	0.009 (0.23)

^ADimensions apply to diameter of rounds, to distance between parallel surfaces of hexagons and squares, and separately to width and thickness of rectangles.

TABLE 2 Permissible Variations in Diameter or Distance

Specified Dimension, in. (mm) ^A	Permissible Variations from Specified Dimensions, in. (mm)	
	+	-
Rod and bar, hot-worked:		
1 (25.4) and under	0.016 (0.41)	0.016 (0.41)
Over 1 (25.4) to 2 (50.8), incl	0.031 (0.79)	0.016 (0.41)
Over 2 (50.8) to 4 (101.6), incl	0.047 (1.19)	0.031 (0.79)
Over 4 (101.6)	0.125 (3.18)	0.063 (1.60)
Rod, rough turned or ground:		
Under 1 (25.4)	0.005 (0.13)	0.005 (0.13)
1 (25.4) and over	0.031 (0.79)	0
Forging quality rod:^B		
Under 1 (25.4)	0.005 (0.13)	0.005 (0.13)
1 (25.4) and over	0.031 (0.79)	0

^ADimensions apply to diameter of rods, to distance between parallel surfaces of hexagons and squares, and separately to width and thickness of rectangles.

^BSpot grinding is permitted to remove minor surface imperfections. The depth of these spot ground areas shall not exceed 3 % of the diameter of the rod.

6.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations in Specification B 880.

7. Mechanical Properties and Other Requirements

7.1 *Mechanical Properties*—The material shall conform to the mechanical properties specified in Table 5.

7.2 *Grain Size*—Annealed UNS Alloys N08120, N08810, N08811, and N08890 shall conform to an average grain size of ASTM No. 5 or coarser.

8. Dimensions and Permissible Variations

8.1 *Diameter, Thickness, or Width*—The permissible variations from the specified dimensions as measured on the diameter or between parallel surfaces of cold-worked rod and bar shall be as prescribed in Table 1, and of hot-worked rod and bar as prescribed in Table 2.

8.2 *Out-of-Round*—Hot-worked rods and cold-worked rods (except “forging quality”) all sizes, in straight lengths, shall not be out-of-round by more than one half the total permissible variations in diameter shown in Table 1 and Table 2, except for hot-worked rods 1/2 in. (12.7 mm) in diameter and under, which may be out-of-round by the total permissible variations in diameter shown in Table 2.

8.3 *Corners*—Cold-worked bars will have practically exact angles and sharp corners.

8.4 *Machining Allowances for Hot-Worked Materials*—When the surfaces of hot-worked products are to be machined, the allowances prescribed in Table 3 are recommended for normal machining operations.

8.5 *Length*—The permissible variations in length of cold-worked and hot-worked rod and bar shall be as prescribed in Table 4.

8.5.1 Rods and bars ordered to random or nominal lengths will be furnished with either cropped or saw-cut ends; material ordered to cut lengths will be furnished with square saw-cut or machined ends.

8.6 Straightness:

8.6.1 The permissible variations in straightness of cold-worked rod and bar as determined by the departure from straightness shall be as prescribed in Table 7.

8.6.2 The permissible variations in straightness of hot-worked rod and bar as determined by the departure from straightness shall be as specified in Table 8.

9. Workmanship, Finish, and Appearance

9.1 The material shall be uniform in quality and condition, smooth, commercially straight or flat, and free of injurious imperfections.

10. Sampling

10.1 Lot:

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

10.1.2 A lot for mechanical properties and grain size testing shall consist of all material from the same heat, nominal diameter or thickness, and condition.

10.1.2.1 Where material cannot be identified by heat, a lot shall consist of not more than 500 lb (227 kg) of material in the same size and condition except that a single piece weighing over 500 lbs shall be considered as one lot.

10.2 Test Material Selection:

10.2.1 *Chemical Analysis*—Representative samples from each lot shall be taken during pouring or subsequent processing.

10.2.1.1 Product (check) analysis shall be wholly the responsibility of the purchaser.

10.2.2 *Mechanical Properties and Grain Size*—Samples of the material to provide test specimens for mechanical properties shall be taken from such locations in each lot as to be representative of that lot.

11. Number of Tests

11.1 *Chemical Analysis*—One test per lot.

11.2 *Tension*—One test per lot.

11.3 *Grain Size*—One test per lot.

12. Specimen Preparation

12.1 Tension test specimens shall be taken from material in the final condition and tested in the direction of fabrication.

12.1.1 All rod and bar shall be tested in full cross-section size when possible. When a full cross-section size test cannot be performed, the largest possible round specimen shown in Test Methods E 8 shall be used. Longitudinal strip specimens