



Designation: B 756 – 00

Standard Specification for Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06110) Rod and Bar¹

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1. Scope

1.1 This specification covers nickel-chromium-molybdenum-tungsten (UNS N06110)² in the form of hot-worked rod and bar and cold-worked rod in the conditions shown in Table 1.

1.2 The values stated in inch-pound units are to be regarded as the standards. The SI units in parentheses are provided for information only.

2. Referenced Documents

2.1 ASTM Standards:

B 755 Specification for Nickel-Chromium-Molybdenum-Tungsten Alloys (UNS N06110) Plate, Sheet, and Strip³

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 1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys⁶

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *bar*—material of rectangular (flats) 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.

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

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

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 New designation established in accordance with ASTM E527 and SAE J1086, Recommended 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 03.06.

TABLE 1 Mechanical Properties

Condition and Diameter or Distance Between Parallel Surfaces in. (mm)	Tensile Strength min, ksi (MPa)	Yield Strength (0.2% Offset), min, ksi (MPa)	Elongation in 2 in. or 50 mm or 4D, min, %
Cold-worked rods and hot-worked rod and bar, annealed:			
Up to 4 (102), incl	95 (655)	45 (310)	60
Over 4 (102) to 10 (254), incl	90 (621)	40 (276)	50
Forging quality (all sizes)	A	A	A

^A Forging quality is furnished to chemical requirements and surface inspection only. No tensile properties are required.

4. Ordering Information

4.1 It is the responsibility of the purchaser to specify all requirements that are necessary for the safe and satisfactory performance of material ordered under this specification. Examples of such requirements include, but are not limited to, the following:

4.1.1 *ASTM Designation*.

4.1.2 *UNS Number*.

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

4.1.4 *Dimensions*—Dimensions including length.

4.1.5 *Condition* (see Appendix).

4.1.6 *Finish* (Section 8).

4.1.7 *Quantity*—Feet, (or metres) or number pieces.

4.1.8 *Certification*— State if certification is required (see Section 15).

4.1.9 *Samples for Product (Check) Analysis*—State whether samples for product (check) analysis should be furnished (see 5.2).

4.1.10 *Purchaser Inspection* (see Section 13)—If purchaser wishes to witness test or inspection of material at place of manufacture, the purchase order must so state indicating which test or inspections are to be witnessed.

5. Chemical Composition

5.1 The material shall conform to the composition limits specified in Table 2.

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

TABLE 2 Chemical Requirements

Element	Composition Limits, %	
	+	-
C	0.15 max	
Mn	1.0 max	
Si	1.0 max	
P	0.015 max	
S	0.015 max	
Cr	28.0 min	33.0 max
Cb	1.0 max	
Co (if determined)	1.0 max	
Mo	9.0 min	12.0 max
Fe	1.0 max	
Al	1.0 max	
Ti	1.0 max	
W	1.0 min	
	4.0 max	
Ni ^A	51.0 min	
Cu	0.50 max	

^A Element shall be determined arithmetically by difference.

6. Mechanical and Other Properties

6.1 *Mechanical Properties*—The material shall conform to the mechanical properties specified in Table 1.

7. Dimensions and Permissible Variations

7.1 *Diameter, Thickness, or Width*—The permissible variations from the specified dimensions of cold worked rod shall be as prescribed in Table 3, and of hot-worked rod and bar as prescribed in Table 4.

7.2 *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 3 and Table 4, 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 4.

7.3 *Machining Allowances for Hot-Worked Materials*—When the surfaces of hot-worked products are to be machined, the allowances prescribed in Table 5 are recommended for normal machining operations.

7.4 *Length*—The permissible variations in length of cold-worked and hot-worked rod and bar shall be as prescribed in Table 6.

7.4.1 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.

TABLE 3 Permissible Variations in Diameter of Cold-Worked Rod

Specified Dimensions, in. (mm)	Permissible Variations from Specified Dimension, in. (mm)	
	+	-
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 1/16 (49.2), incl	0.0015 (0.04)	0.003 (0.08)
Over 1 1/16 (49.2) to 2 1/2 (63.5), incl	0.002 (0.05)	0.004 (0.10)

TABLE 4 Permissible Variations in Diameter or Distance Between Parallel Surfaces of Hot-Worked Rod and Bar

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 quantity rod: ^B		
Under 1 (25.4)	0.005 (0.13)	0.005 (0.13)
1 (25.4) and over	0.031 (0.79)	0

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

^B Spot 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.

7.5 Straightness:

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

7.5.2 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.

8. Workmanship, Finish, and Appearance

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

9. Sampling

9.1 Lot Definition:

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

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

9.1.2.1 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 lb shall be considered as one lot.

9.2 Test Material Selection:

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

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

9.2.2 *Mechanical Properties*—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.

10. Number of Tests

10.1 *Chemical Analysis*—One test per lot.

10.2 *Tension*—One test per lot.

11. Specimen Preparation

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