Designation: B756 – 00(Reapproved 2011)

Standard Specification for Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06110) Rod and Bar[1]

This standard is issued under the fixed designation B756; 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 (ε) indicates an editorial change since the last revision or reapproval.

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 standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *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 (MSDS) 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:*[3]

B755 Specification for Nickel-Chromium-Molybdenum-Tungsten Alloys (UNS N06110) Plate, Sheet, and Strip

B880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys

E8 Test Methods for Tension Testing of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

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 *Definitions of Terms Specific to This Standard:*

3.1.1 *bar, n*—material of rectangular (flats) or square solid section up to and including 10 in. (254 mm) in width and ⅛ in. (3.2 mm) and over in thickness in straight lengths.

3.1.1.1 *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 B755, provided the mechanical property requirements of Specification B755 are met.

3.1.2 *rod, n*—material 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 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.

[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 Practice E527 and SAE J1086, Recommended Practice for Numbering Metals and Alloys (UNS).

[3] 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.

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.

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.

5.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations in accordance with Specification B880.

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.

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 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)

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.

7.2 *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 ½ 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.

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.