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Designation: B 425 – 99

Standard Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825 and UNS N08221)* Rod and Bar[1]

This standard is issued under the fixed designation B 425; 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[2] covers nickel-iron-chromium-molybdenum-copper alloy (UNS N08825 and UNS N08221)* in the form of hot-finished and cold-drawn rounds, squares, hexagons, and rectangles.

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.

1.3 The following precautionary caveat pertains only to the test methods portion, Section 12, of this specification: *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard 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 424 Specification for Ni-Fe-Cr-Mo-Cu Alloy (UNS N08825 and UNS N08221) Plate, Sheet, and Strip[3]

B 880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys[3]

E 8 Test Methods for Tension Testing of Metallic Materials[4]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[5]

E 1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys[6]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *bar*—material of rectangular (flats), hexagonal, 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. (254 mm) and under may be furnished as hot-rolled plate with sheared or cut edges in accordance with Specification B 424, provided the mechanical property requirements of this specification are met.

3.1.2 *rod*—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 and date of issue,

4.1.2 UNS number,

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

4.1.4 *Dimensions*, including length,

4.1.5 Condition (see Appendix X1),

4.1.6 Finish (see Appendix X1),

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

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

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

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 (Section 13).

5. Chemical Composition

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

[1] This specification is under the jurisdiction of ASTM Committee B-2 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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* New designation established in accordance with Practice E 527 and SAE J 1086, Practice for Numbering Metals and Alloys (UNS).

[2] For ASME Boiler and Pressure Vessel Code applications, see related Specification SB-425 in Section II of that code.

[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.

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TABLE 1 Chemical Requirements

Element	UNS N08825	UNS N08221
Nickel	38.0–46.0	39.0–46.0
Chromium	19.5–23.5	20.0–22.0
Iron[A]	22.0 min	balance
Manganese	1.0 max	1.0 max
Carbon	0.05 max	0.025 max
Copper	1.5–3.0	1.5–3.0
Silicon	0.5 max	0.5 max
Sulfur	0.03 max	0.03 max
Aluminum	0.2 max	0.2 max
Titanium	0.6–1.2	0.6–1.0
Molybdenum	2.5–3.5	5.0–6.5

[A] Element shall be determined arithmetically by difference.

5.2 If a product (check) analysis is performed by the purchaser, it shall be done per B 880 and the material shall conform to the product (check) analysis variations defined in Table 1 of B 880.

6. Mechanical Properties and Other Requirements

6.1 *Mechanical Properties*—The material shall conform to the mechanical properties specified in Table 2.

7. Dimensions and Permissible Variations

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

7.4 *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.

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

7.5.1 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.

7.6 *Straightness*:

TABLE 3 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)	
	Plus	Minus
Rounds:		
1/16 (1.6) to 3/16 (4.8), excl	0	0.002 (0.05)
3/16 (4.8) to ½(12.7), excl	0	0.003 (0.08)
½ (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 2½ (63.5), incl	0.002 (0.05)	0.004 (0.10)
Hexagons, squares, rectangles:		
½ (12.7) and less	0	0.004 (0.10)
Over ½ (12.7) to 7/8(22.2), incl	0	0.005 (0.13)
Over 7/8 (22.2) to 1¼(31.8), incl	0	0.007 (0.18)
Over 1 ¼ (31.8) to 2 (50.8), incl	0	0.009 (0.23)

[A] Dimensions apply to diameter of rounds, to distance between parallel surfaces of hexagons and squares, and separately to width and thickness of rectangles.

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 Dimension, in. (mm)	
	Plus	Minus
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

[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.

7.6.1 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.

7.6.2 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.

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.

TABLE 2 Mechanical Properties (Rod and Bar)

Alloy	Condition	Tensile Strength min, ksi (MPa)	Yield Strength 0.2 % offset, min, ksi (MPa)	Elongation in 2 in. or 50 mm or 4[D], min,%
UNS N08825	*Annealed:* Hot-finished, cold–drawn	85 (586)	35 (241)	30[A]
	Forging Quality:	[B]	[B]	[B]
UNS N08221	All sizes annealed	79 (544)	34 (235)	30

[A] Not applicable to diameters or cross sections under 3/32 in. (2.4 mm).
[B] Forging quality is furnished to chemical requirements and surface inspection only. No tensile properties are required.