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Standard Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Molybdenum-Chromium-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod[1]

This standard is issued under the fixed designation B 574; 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.

This standard has been approved for use by agencies of the Department of Defense.

ϵ[1] NOTE—Editorial changes were made in 6.1, 7.1, and 7.2 in October 2006.

1. Scope

1.1 This specification[2] covers rod of low-carbon nickel-chromium-molybdenum alloys (UNS N10276, N06022, N06035, N06455, N06058, and N06059)*, low-carbon nickel-molybdenum-chromium-tantalum (UNS N06210), low-carbon nickel-chromium-molybdenum-copper alloy (UNS N06200), and low-carbon nickel-chromium-molybdenum-tungsten (UNS N06686) as shown in Table 1, for use in general corrosive service.

1.2 The following products are covered under this specification:

1.2.1 Rods 5⁄16 to ¾ in. (7.94 to 19.05 mm), exclusive, in diameter, hot or cold finished, solution annealed and pickled, or mechanically descaled.

1.2.2 Rods ¾ to 3½ in. (19.05 to 88.9 mm), inclusive, in diameter, hot or cold finished, solution annealed, ground or turned.

1.2.3 Rods ¼ to 3 ½ in. (6.35 to 88.9 mm), inclusive, in diameter, solution annealed, cold finished, as cold finished, ground or turned (N06059 and N06686 only, see Table 2 and Table 3).

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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]

B 880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys
E 8 Test Methods for Tension Testing of Metallic Materials
E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition
E 527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)
E 1473 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 *rod*, *n*—a product of round solid section furnished in straight lengths.

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[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-574 in Section II of that Code.

* New designation established in accordance with Practice E 527and SAE J1086, 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 Chemical Requirements

Element	Composition Limits, %								
	Alloy N06035	Alloy N10276	Alloy N06022	Alloy N06455	Alloy N06059	Alloy N06058	Alloy N06200	Alloy N06210	Alloy N06686
Molybdenum	7.60–9.00	15.0–17.0	12.5–14.5	14.0–17.0	15.0–16.5	19.0 - 21.0	15.0–17.0	18.0–20.0	15.0-17.0
Chromium	32.25–34.25	14.5–16.5	20.0–22.5	14.0–18.0	22.0–24.0	20.0- 23.0	22.0–24.0	18.0–20.0	19.0-23.0
Iron	2.00 max	4.0–7.0	2.0–6.0	3.0 max	1.5, max	1.5, max	3.0 max	1.0 max	5.0 max
Tungsten	0.60 max	3.0–4.5	2.5–3.5	...	...	0.3 max	...	...	3.0-4.4
Cobalt, max	1.00	2.5	2.5	2.0	0.3	0.3 max	2.0 max	1.0	...
Carbon, max	0.050	0.010	0.015	0.015	0.010	0.010	0.010	0.015	0.010
Silicon, max	0.60	0.08	0.08	0.08	0.10	0.10	0.08	0.08	0.08
Manganese, max	0.50	1.0	0.50	1.0	0.5	0.5	0.5	0.5	0.75
Vanadium, max	0.20	0.35	0.35	...	...	...	...	0.35	...
Phosphorus, max	0.030	0.04	0.02	0.04	0.015	0.015	0.025	0.02	0.04
Sulfur, max	0.015	0.03	0.02	0.03	0.010	0.010	0.010	0.02	0.02
Titanium	...	...	...	0.7 max	...	...	...	...	0.02-0.25
Nickel	remainder[A]	remainder[A]	remainder[A]	remainder[A]	Bal	Bal	remainder[A]	remainder[A]	remainder[A]
Aluminum	0.40 max	...	...	...	0.1–0.4	0.40 max	0.50 max	...	...
Copper	0.30 max	...	...	...	0.50 max	0.50 max	1.3–1.9	...	...
Tantalum	...	...	...	...	...	...	...	1.5–2.2	...

[A] See 12.1.1.

TABLE 6 2 Permissible Variations in Length of Rods

Specified Diameter, in. (mm)	RandoPerm-missibll leng Variathions, in. (mm)		
	2 to 12 ft (610 to 3660 mm) long wDith notamore than 25 weighr		
	Multiple lengths+	Furnished in multiples of a specified unit length, within the length limits indicated above. For each multiple, an allowance of	Out % of Roundner 4 ft (1.22ss, m).ax
¼ in. (6.35 mm) shall be made for cutting, unless otherwise specified7⁄16. At the manufacturer's option, individual specified unitlengths may be furnished.			
¼ mm) shall be made for cutting, unless7⁄16 (6.35–11.11), inclengths may be furnished.			
	Nominal lengths	Specified nominal lengths ha0.012 (0.30)	0.018 (0.46)
	0.012 (0.30)	0.012 (0.30)	0.018 (0.46)
Oving a range of not less than 2 ft (610 mm) with no short lengths a5⁄allowed	.014 (0.36)	0.014 (0.36)	0.020 (0.51)
Over 7⁄16 less than 2 ft (610 mm) with no short lengths5⁄8 (11.11–15.87), incl	0.014 (0.36)	0.014 (0.36)	0.020 (0.51)
Cut lengths	A specified length to which all rods shall be cut 0.016 (0.41)	0.016 (0.41)	0.024 (0.61)
Over 5⁄8 –¾ (15.87–19.05), excl	0.016 (0.41)	0.016 (0.41)	0.024 (0.61)
¾ with a permissible variation of ±½ incl	0. (3.25)	0.017 mm) –	0.
¾ with a permissible variation of ±½ (19.05–88.9), incl	0.010 (0.25)	0.010 (0.25)	0.010 (0.25)

4. Ordering Information

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

4.1.1 *Alloy*—Table 1.

4.1.2 *Dimensions*—Nominal diameter and length. The shortest useable multiple length should be specified (Table 4).

4.1.3 *Certification*— State if certification or a report of test results is required (Section 15).

4.1.4 *Purchaser Inspection*—State which tests or inspections are to be witnessed (Section 13).

4.1.5 *Samples for Product (Check) Analysis*—State whether samples should be furnished (9.2.2).

5. Chemical Composition

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

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

TABLE 2 3 Permissible Variations in Diameter and Out-of-Roundness of As Cold Finished Rods

Specified Diameter, in. (mm)		Permissible Variations, in. (mm)			
Diameter		y	Ou Grade y	Tensile St of Roundn, psi (MPa) Grade	Yi Tensile Stren
+ N06059 –7/16 (6.35–11.11), incl	1	–120 (827) 120 (827) 0.012 (0.30)	85 (586) 0.012 (0.30)	85 (586) 20 0.018 (0.46)	
	2	135 (931)	125 (862)	20	
	3	160 (1103)	150 (1034)	15	
Over 7/16 –5/8 (11.11–15.87), incl		0.014 (0.36)	0.014 (0.36)	0.020 (0.51)	
N06686 Over 5/8 –3/4 (15.87–19.05), excl	1	120 (827) 0.016 (0.41)	85 (586) 0.016 (0.41)	20 0.024 (0.61)	
	2	135 (931)	125 (862)	20	
–3½ (19.05–88.9), incl		0.010 (0.25)	0.010 (0.25)	0.010 (0.25)	
	3	160 (1103)	150 (1034)	20	

[A] *D* refers to the diameter of the tension specimen.

TABLE 5 4 Mechanical Property Requirements for Hot or Cold Finished, Solution Annealed Rods

Alloy	Tensile Strength, min, psi (MPa)	Yield Str Diameength (0.2 % Offset), r, m in, psi (MPa)	Elongation in 2 in. (50.8mm) or 4D[A] min, %	
			N10276	
	100 000 (690)		41 000 (283)	40Diame
N06022	100 000 (690)	45 000 (310)	45	
+	100 000 (690)	45 000 (310)	45	
N06035	85 000 (586)35 000 (241)	30		
	N06455			100 000 (
	N06455			100 000 (
N06058 5/16 –7/16 (7.94–11.11), incl	110 000 (760) 0.012 (0.30)	52 000 (360) 0.012 (0.30)	40 0.018 (0.46)	
N06059	100 000 (690)	45 000 (310)	45	
Over 7/16 –5/8 (11.11–15.87), incl	0.014 (0.36)	0.014 (0.36)	0.020 (0.51)	
N06200	100 000 (690)	45 000 (310)	45	
Over 5/8 –3/4 (15.87–19.05), excl (0.61)	0.016 (0.41)	0.016 (0.41)	0.024 5	
	N06686			100 000 (
	N06686			100 000 (
N062 3/4 10	100 000 (690)	45 000 (310)	45	
3/4 –3½ (19.05–88.9), incl	0.010 (0.25)	0	0.008 (0.20)	

[A] *D* refers to the diameter of the tension specimen.

6. Mechanical Properties and Other Requirements

6.1 The mechanical properties of the material at room temperature shall conform to those shown in Table 3 and Table 5.

7. Dimensions and Permissible Variations

7.1 *Diameter*—The permissible variations from the specified diameter shall be as prescribed in Table 2 and Table 4.

7.2 *Out of Roundness*— The permissible variation in roundness shall be as prescribed in Table 2 and Table 4.

7.3 *Machining Allowances*—When the surfaces of finished material are to be machined, the following allowances are suggested for normal machining operations.

7.3.1 *As-finished (Annealed and Descaled)* —For diameters of 5/16 to 11/16 in. (7.94 to 17.46 mm) inclusive, an allowance of 1/16 in. (1.59 mm) on the diameter should be made for finish machining.

7.4 *Length*:

7.4.1 Unless multiple, nominal, or cut lengths are specified, random mill lengths shall be furnished.

7.4.2 The permissible variations in length of multiple, nominal, or cut length rod shall be as prescribed in Table 6. Where rods are ordered in multiple lengths, a 1/4-in. (6.35-mm) length addition shall be allowed for each uncut multiple length.