



Designation: B574 – 23

Standard Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Molybdenum-Chromium, Low-Carbon Nickel-Molybdenum-Chromium-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod and Bar¹

This standard is issued under the fixed designation B574; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

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

1. Scope*

1.1 This specification² covers rod and bar of low-carbon nickel-chromium-molybdenum alloys (UNS N10276, N06022, N06035, N06044, N06455, N06058, and N06059), low-carbon nickel-molybdenum-chromium (UNS N10362), 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 and Bars $\frac{5}{16}$ in. to $\frac{3}{4}$ in. (7.94 mm to 19.05 mm), exclusive, in dimension³, solution annealed and pickled, or mechanically descaled.

1.2.2 Rods and Bars $\frac{3}{4}$ in. to $3\frac{1}{2}$ in. (19.05 mm to 88.9 mm), inclusive, in dimension³, solution annealed, ground or turned.

1.2.3 Rods and Bars $\frac{1}{4}$ in. to $3\frac{1}{2}$ in. (6.35 mm to 88.9 mm), inclusive, in dimension³, solution annealed, cold worked, ground or turned (N06022, N06059, N06686, and N10276, see **Table 2** and **Table 3**).

1.3 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 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.

³ Dimension applies to diameter of rods, to distance between parallel surfaces of squares and hexagonals, and separately to width and thickness of rectangles.

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 Safety Data Sheet (SDS) for this product/material as provided by the manufacturer; to establish appropriate safety, health, and environmental practices, and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*⁴

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

B899 Terminology Relating to Non-ferrous Metals and Alloys

E8/E8M Test Methods for Tension Testing of Metallic Materials

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

E55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition

E1473 Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys

3. Terminology

3.1 Definitions:

⁴ 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.

*A Summary of Changes section appears at the end of this standard

TABLE 1 Chemical Requirements^{A,B}
Composition Limits, %

| Element | Alloy N06035 | Alloy N06044 | Alloy N10276 | Alloy N06022 | Alloy N06455 | Alloy N06059 | Alloy N06058 | Alloy N06200 | Alloy N10362 | Alloy N06210 | Alloy N06686 |
|---------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Molybdenum | 7.60-9.00 | 0.80-1.20 | 15.0-17.0 | 12.5-14.5 | 14.0-17.0 | 15.0-16.5 | 18.5-21.0 | 15.0-17.0 | 21.5-23.0 | 18.0-20.0 | 15.0-17.0 |
| Chromium | 32.25-34.25 | 43.5-45.3 | 14.5-16.5 | 20.0-22.5 | 14.0-18.0 | 22.0-24.0 | 20.0-23.0 | 22.0-24.0 | 13.8-15.6 | 18.0-20.0 | 19.0-23.0 |
| Iron | 2.00 | 0.3 | 4.0-7.0 | 2.0-6.0 | 3.0 | 1.5 | 1.5 | 3.0 | 1.25 | 1.0 | 5.0 |
| Tungsten | 0.60 | ... | 3.0-4.5 | 2.5-3.5 | ... | ... | 0.3 | ... | ... | ... | 3.0-4.4 |
| Cobalt | 1.00 | ... | 2.5 | 2.5 | ... | 0.3 | 0.3 | 2.0 | ... | 1.0 | ... |
| Carbon | 0.050 | 0.02 | 0.010 | 0.015 | 0.015 | 0.010 | 0.010 | 0.010 | 0.010 | 0.015 | 0.010 |
| Silicon | 0.60 | 0.20 | 0.08 | 0.08 | 0.08 | 0.10 | 0.10 | 0.08 | 0.08 | 0.08 | 0.08 |
| Manganese | 0.50 | 0.07-0.30 | 1.0 | 0.50 | 1.0 | 0.5 | 0.5 | 0.5 | 0.60 | 0.5 | 0.75 |
| Vanadium | 0.20 | ... | 0.35 | 0.35 | ... | ... | ... | ... | ... | 0.35 | ... |
| Phosphorus | 0.030 | 0.020 | 0.04 | 0.02 | 0.04 | 0.015 | 0.015 | 0.025 | 0.025 | 0.02 | 0.04 |
| Sulfur | 0.015 | 0.020 | 0.03 | 0.02 | 0.03 | 0.010 | 0.010 | 0.010 | 0.010 | 0.02 | 0.02 |
| Titanium | ... | 0.10-0.30 | ... | ... | 0.7 | ... | ... | ... | ... | ... | ... |
| Nickel ^C | remainder | remainder | remainder | remainder | remainder | remainder | remainder | remainder | remainder | remainder | remainder |
| Aluminum | 0.40 | 0.30 | ... | ... | ... | 0.1-0.4 | 0.40 | 0.50 | 0.50 | ... | ... |
| Copper | 0.30 max | ... | ... | ... | ... | 0.50 | 0.50 | 1.3-1.9 | ... | ... | ... |
| Tantalum | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Nitrogen | ... | ... | ... | ... | ... | ... | 0.02-0.15 | ... | ... | 1.5-2.2 | ... |

^A All values are maximums unless specified as a minimum or a range is provided.

^B Where ellipses (. . .) appear in this table there is no requirement and the element need neither be analyzed for or reported.

^C Nickel shall be determined arithmetically by difference.

TABLE 2 Permissible Variations in Dimension and Out-of-Roundness of As Cold-Worked and Bars

| Specified Dimension, in. (mm) | Permissible Variations, in. (mm) | | |
|------------------------------------|----------------------------------|--------------|-----------------------|
| | Dimension ^A | | Out of Roundness, max |
| | + | - | |
| 1/4 -7/16 (6.35–11.11), incl | 0.012 (0.30) | 0.012 (0.30) | 0.018 (0.46) |
| Over 7/16 -5/8 (11.11–15.87), incl | 0.014 (0.36) | 0.014 (0.36) | 0.020 (0.51) |
| Over 5/8 -3/4 (15.87–19.05), excl | 0.016 (0.41) | 0.016 (0.41) | 0.024 (0.61) |
| 3/4 -3 1/2 (19.05–88.9), incl | 0.010 (0.25) | 0.010 (0.25) | 0.010 (0.25) |

^A Dimension applies to diameter of rods, to distance between parallel surfaces of squares and hexagonals, and separately to width and thickness of rectangles.

TABLE 3 Mechanical Property Requirements for Cold-Worked Rods and Bars

| Alloy | Grade | Tensile Strength, min, psi (MPa) | Yield Strength (0.2 % Offset), min, psi (MPa) | Elongation in 2 in. (50.8 mm) or 4D ^A min, % |
|---------------------|-------|----------------------------------|---|---|
| N06059 | 1 | 120 (827) | 85 (586) | 20 |
| | 2 | 135 (931) | 125 (862) | 20 |
| | 3 | 160 (1103) | 150 (1034) | 15 |
| N06686 | 1 | 120 (827) | 85 (586) | 20 |
| | 2 | 135 (931) | 125 (862) | 20 |
| | 3 | 160 (1103) | 150 (1034) | 20 |
| N06022 ^B | ... | 120 000 (825) | 80 000 (550) | 25 |
| N10276 ^B | ... | 120 000 (825) | 80 000 (550) | 25 |

^A D refers to the diameter of the tension specimen.

^B Up to 2.5 in. (63 mm) thickness.

TABLE 4 Permissible Variations in Dimension and Out-of-Roundness of Hot or Cold Finished, Solution Annealed Rods and Bars

| Specified Dimension, in. (mm) | Permissible Variations, in. (mm) | | |
|---|----------------------------------|--------------|-----------------------|
| | Dimension ^A | | Out of Roundness, max |
| | + | - | |
| 5/16 Hot-Finished, Annealed, and Descaled Rods | | | |
| 5/16 -7/16 (7.94–11.11), incl | 0.012 (0.30) | 0.012 (0.30) | 0.018 (0.46) |
| Over 7/16 -5/8 (11.11–15.87), incl | 0.014 (0.36) | 0.014 (0.36) | 0.020 (0.51) |
| Over 5/8 -3/4 (15.87–19.05), excl | 0.016 (0.41) | 0.016 (0.41) | 0.024 (0.61) |
| Hot-Finished, Annealed, and Ground or Turned Rods | | | |
| 3/4 -3 1/2 (19.05–88.9), incl | 0.010 (0.25) | 0 | 0.008 (0.20) |

^A Dimension applies to diameter of rods, to distance between parallel surfaces of squares and hexagonals, and separately to width and thickness of rectangles.

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

| Alloy | Tensile Strength, min, psi (MPa) | Yield Strength (0.2 % Offset), min, psi (MPa) | Elongation in 2 in. (50.8 mm) or 4D ^A min, % |
|--------|----------------------------------|---|---|
| N10276 | 100 000 (690) | 41 000 (283) | 40 |
| N06022 | 100 000 (690) | 45 000 (310) | 45 |
| N06035 | 85 000 (586) | 35 000 (241) | 30 |
| N06044 | 100 000 (690) | 41 000 (280) | 30 |
| N06455 | 100 000 (690) | 40 000 (276) | 40 |
| N06058 | 110 000 (760) | 52 000 (360) | 40 |
| N06059 | 100 000 (690) | 45 000 (310) | 45 |
| N06200 | 100 000 (690) | 45 000 (310) | 45 |
| N10362 | 105 000 (725) | 45 000 (310) | 40 |
| N06686 | 100 000 (690) | 45 000 (310) | 45 |
| N06210 | 100 000 (690) | 45 000 (310) | 45 |

^A D refers to the diameter of the tension specimen.

3.1.1 For definitions of terms used in this specification, refer to Terminology **B899**.

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 *Quantity (mass length, or number of pieces);*
- 4.1.2 *Name of material;*

4.1.3 *ASTM specification designation and year date to which the product is to be furnished and be certified as meeting;*

4.1.4 *Condition, (hot rolled, cold drawn, annealed, heat treated);*

4.1.5 *Grade designation;*

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

4.1.7 *Shape and finish characteristics (surface finish, type of edge required).*