
This standard is issued under the fixed designation B573; 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 specification2 covers nickel-molybdenum-chromium-iron alloys (UNS N10003 and UNS N10242)* rod for use in general corrosive service.

1.2 The following products are covered under this specification:

1.2.1 Rods 5⁄16 to 3⁄4 in. (7.94 to 19.05 mm) excl in diameter, hot or cold finished, annealed, and pickled or mechanically descaled.

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

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.

1.4 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 Materials 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

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
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 rod, n—a product 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 Dimensions—Nominal diameter and length. The shortest usable multiple length shall be specified (Table 1).

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

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

4.1.4 Samples for Product (Check) Analysis—State whether samples shall be furnished (9.2.2).

5. Chemical Composition

5.1 The material shall conform to the requirements as to chemical composition prescribed in Table 2.

5.2 If a product (check) analysis is made by the purchaser, the material shall conform to the requirements specified in Table 2 subject to the permissible tolerances in Specification B880.

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.

7. Dimensions and Permissible Variations

7.1 Diameter—The permissible variations from the specified diameter shall be as prescribed in Table 4.
TABLE 1 Permissible Variations in Length of Rods

<table>
<thead>
<tr>
<th>Random mill lengths</th>
<th>2 to 12 ft (610 to 3660 mm) long with not more than 25 weight % under 4 ft (1.22 m).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple lengths</td>
<td>Furnished in multiples of a specified unit length, within the length limits indicated above. For each multiple, an allowance of 1/4 in. (6.35 mm) shall be made for cutting, unless otherwise specified. At the manufacturer's option, individual specified unit lengths may be furnished.</td>
</tr>
<tr>
<td>Nominal lengths</td>
<td>Specified nominal lengths having a range of not less than 2 ft (610 mm) with no short lengths allowed.</td>
</tr>
<tr>
<td>Cut lengths</td>
<td>A specified length to which all rods shall be cut with a permissible variation of + 1/16 in. (3.17 mm) – 0.</td>
</tr>
</tbody>
</table>

TABLE 2 Chemical Requirements

<table>
<thead>
<tr>
<th>Element</th>
<th>Composition, %</th>
<th>UNS N10242</th>
<th>UNS N10003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td>7.0-9.0</td>
<td>6.0-8.0</td>
<td></td>
</tr>
<tr>
<td>Iron, max</td>
<td>2.0</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>0.05 max</td>
<td>0.04-0.08</td>
<td></td>
</tr>
<tr>
<td>Silicon, max</td>
<td>0.80</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Cobalt, max</td>
<td>1.00</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>Manganese, max</td>
<td>0.80</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Tungsten, max</td>
<td>...</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Vanadium, max</td>
<td>...</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Molybdenum</td>
<td>24.0-26.0</td>
<td>15.0–18.0</td>
<td></td>
</tr>
<tr>
<td>Phosphorus, max</td>
<td>0.030</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td>Sulfur, max</td>
<td>0.015</td>
<td>0.020</td>
<td></td>
</tr>
<tr>
<td>Aluminum plus titanium, max</td>
<td>...</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Copper, max</td>
<td>0.50</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>Boron, max</td>
<td>0.006</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>remainder</td>
<td>remainder</td>
<td>remainder</td>
</tr>
<tr>
<td>Aluminum, max</td>
<td>0.50</td>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 3 Mechanical Property Requirements

<table>
<thead>
<tr>
<th>UNS</th>
<th>Tensile Strength, min. ksi (MPa)</th>
<th>Yield Strength (0.2 % Offset), min. ksi (MPa)</th>
<th>Elongation in 2 in. (50.8 mm) or 4D* min, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>N10003</td>
<td>100 000(690)</td>
<td>40 000(280)</td>
<td>35</td>
</tr>
<tr>
<td>N10242</td>
<td>105 000(725)</td>
<td>45 000(310)</td>
<td>40</td>
</tr>
</tbody>
</table>

*4D—D refers to the diameter of the tension specimen.

7.5.2 Rods ordered to cut lengths shall be furnished with square saw cut or machined ends.

7.6 Weight—For calculation of mass or weight, the following densities shall be used:

<table>
<thead>
<tr>
<th>Alloy</th>
<th>lb/ft³</th>
<th>g/cm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>N10003</td>
<td>0.317</td>
<td>6.78</td>
</tr>
<tr>
<td>N10242</td>
<td>0.327</td>
<td>9.05</td>
</tr>
</tbody>
</table>

7.7 Straightness—The maximum curvature (depth of chord) shall not exceed 0.050 in. multiplied by the length of the chord in feet (0.04 mm multiplied by the length in centimetres).

8. Workmanship, Finish, and Appearance

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

9. Sampling

9.1 Lots for Chemical Analysis and Mechanical Testing:
9.1.1 A lot for chemical analysis shall consist of one heat.
9.1.2 A lot of bar for mechanical testing shall be defined as the material from one heat in the same condition and specified diameter.

9.2 Sampling for Chemical Analysis:
9.2.1 A representative sample shall be obtained from each heat during pouring or subsequent processing.
9.2.2 Product (check) analysis shall be wholly the responsibility of the purchaser.

9.3 Sampling for Mechanical Testing—A representative sample shall be taken from each lot of finished material.

10. Number of Tests and Retests

10.1 Chemical Analysis—One test per heat.
10.2 Tension Tests—One test per lot.
10.3 Retests—If the specimen used in the mechanical test of any lot fails to meet the specified requirements, two additional specimens shall be taken from different sample pieces and tested. The results of the tests on both of these specimens shall meet the specified requirements.

11. Specimen Preparation

11.1 Tension test specimens shall be taken from material after final heat-treatment and tested in the direction of fabrication.
11.2 Tension test specimens shall be any of the standard or subsized specimens shown in Test Methods E8.
11.3 In the event of disagreement, the referee specimen shall be the largest possible round specimen shown in Test Methods E8.

12. Test Methods

12.1 The chemical composition and mechanical properties of the material as enumerated in this specification shall be determined, in case of disagreement, in accordance with the following ASTM methods:
12.1.1 Chemical Analysis—Test Methods E1473.
12.1.2 Tension Test—Test Methods E8.
12.1.3 Determining Significant Places—Practice E29.
12.2 For purposes of determining compliance with the limits in this specification, an observed value or a calculated value shall be rounded in accordance with the rounding method of Practice E29:

- Requirements
- Rounded Unit for Observed or Calculated Value
- Chemical composition and tolerance nearest unit in the last right-hand place of figures of the specified limit
- Tensile strength and yield strength nearest 1000 psi (7 MPa)
- Elongation nearest 1%

13. Inspection

13.1 Inspection of the material shall be made as agreed upon between the manufacturer and the purchaser as part of the purchase contract.

14. Rejection and Rehearing

14.1 Material tested by the purchaser that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

15. Certification

15.1 When specified in the purchase order or contract, a manufacturer's certification shall be furnished to the purchaser stating that material has been manufactured, tested, and inspected in accordance with this specification, and that the test results on representative samples meet specification requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

16. Product Marking

16.1 Each piece of material ½ in. (12.7 mm) and over in diameter shall be marked with this specification number, name of the material, and size of the product.

16.2 Each bundle or shipping container shall be marked with the name of the material; this specification number; the size; gross, tare, and net weight; consignor and consignee address; contract or order number; and such other information as may be defined in the contract or order.

17. Keywords

17.1 rod; UNS N10003; UNS N10242

APPENDIX

(Nonmandatory Information)

XI. HEAT TREATMENT

X1.1 Proper heat treatment during or subsequent to fabrication is necessary for optimum performance, and the manufacturer shall be consulted for details.

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