1. **Scope**

1.1 This specification\(^2\) covers nickel-iron chromium-molybdenum alloy (UNS N08320)\(^*\) rod for use in general corrosive service.

1.2 The following products are covered under this specification:

1.2.1 Rods \(\frac{3}{16}\) to \(\frac{3}{4}\) in. (7.94 to 19.05 mm) excl in diameter, hot or cold finished, solution annealed and pickled or mechanically descaled.

1.2.2 Rods \(\frac{3}{4}\) to \(3\frac{1}{2}\) in. (19.05 to 88.9 mm) incl in diameter, hot or cold finished, solution 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 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:*\(^3\)

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 *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 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 useable 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 composition limits specified 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, Mass 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>Type of Length</th>
<th>Permissible Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random mill lengths</td>
<td>±0.0625 in. (1.6 mm)</td>
</tr>
<tr>
<td>Multiple lengths</td>
<td>±0.0625 in. (1.6 mm)</td>
</tr>
<tr>
<td>Nominal lengths</td>
<td>±0.0625 in. (1.6 mm)</td>
</tr>
<tr>
<td>Cut lengths</td>
<td>±0.0625 in. (1.6 mm)</td>
</tr>
</tbody>
</table>

TABLE 2 Chemical Requirements

<table>
<thead>
<tr>
<th>Element</th>
<th>Composition Limits, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel</td>
<td>25.0–27.0</td>
</tr>
<tr>
<td>Iron</td>
<td>remainder*</td>
</tr>
<tr>
<td>Chromium</td>
<td>21.0–23.0</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>4.0–6.0</td>
</tr>
<tr>
<td>Manganese, max</td>
<td>2.5</td>
</tr>
<tr>
<td>Carbon, max</td>
<td>0.05</td>
</tr>
<tr>
<td>Titanium, min</td>
<td>4 × carbon</td>
</tr>
<tr>
<td>Silicon, max</td>
<td>1.00</td>
</tr>
<tr>
<td>Phosphorus, max</td>
<td>0.04</td>
</tr>
<tr>
<td>Sulfur, max</td>
<td>0.03</td>
</tr>
</tbody>
</table>

* See 12.1.1.

TABLE 3 Mechanical Property Requirements

<table>
<thead>
<tr>
<th>Tensile Strength, min, psi (MPa)</th>
<th>Yield Strength (0.2 % Offset), mini psi (MPa)</th>
<th>Elongation in 2 in. (50.8) or 4D, min, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 000 (517)</td>
<td>28 000 (193)</td>
<td>35</td>
</tr>
</tbody>
</table>

*D refers to the diameter of the tension specimen.

7.6 Weight—The material covered by this specification shall be assumed to weigh 0.291 lb/in.³ (8.05 g/cm³).

7.7 Straightness—The maximum curvature (depth of cord) shall not exceed 0.050 in. multiplied by the length of the cord 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:

9.3.1 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 a 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.
TABLE 4 Permissible Variations in Diameter and Out-of-Roundness of Finished Rods

<table>
<thead>
<tr>
<th>Specified Diameter, in. (mm)</th>
<th>Hot-Finished, Annealed, and Descaled Rods</th>
<th>Hot-Finished, Annealed, and Ground or Turned Rods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plus</td>
<td>Minus</td>
</tr>
<tr>
<td></td>
<td>Diameter</td>
<td>Out of Roundness, max</td>
</tr>
<tr>
<td>% to 5/32 (7.94–11.11), incl</td>
<td>0.012 (0.30)</td>
<td>0.018 (0.46)</td>
</tr>
<tr>
<td>Over 5/32 to 5/16 (11.11–15.87), incl</td>
<td>0.014 (0.36)</td>
<td>0.020 (0.51)</td>
</tr>
<tr>
<td>Over % to 5/4 (15.87–19.05), excl</td>
<td>0.016 (0.41)</td>
<td>0.024 (0.61)</td>
</tr>
<tr>
<td>% to 3/8 (19.05–22.22), incl</td>
<td>0.010 (0.25)</td>
<td>0.008 (0.20)</td>
</tr>
</tbody>
</table>

13. Inspection

13.1 Inspection of the material shall be made as agreed upon by 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 made.

16. Product Marking

16.1 Each piece of material ½ in. (12.7 mm) or over in diameter shall be marked with the specification number, alloy, heat number, manufacturer’s identification, and size. The markings shall have no deleterious effect on the material or its performance and shall be sufficiently stable to withstand normal handling.

16.2 Each bundle or shipping container shall be marked with the name of the material; this specification number; alloy; 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 N08320

APPENDIX

(Nonmandatory Information)

X1. 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.