Standard Specification for
Iron-Nickel-Chromium-Molybdenum Alloy (UNS N08028)
Plate, Sheet, and Strip

This standard is issued under the fixed designation B709; 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 covers iron-nickel-chromium-molybdenum alloy (UNS N08028)* plate, sheet, and strip in the solution-annealed condition.

1.2 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.

1.3 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:

B880 Specification for General Requirements for Chemical Check Analysis Limits for Nickel, Nickel Alloys and Cobalt Alloys
B906 Specification for General Requirements for Flat-Rolled Nickel and Nickel Alloys Plate, Sheet, and Strip
E8/E8M Test Methods for Tension Testing of Metallic Materials

3. Ordering Information

3.1 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 those specified in Ordering Information Section in Specification B906.

4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification B906, unless otherwise specified herein.

5. Materials and Manufacture

5.1 Heat Treatment—The final heat treatment shall be a solution-anneal. Minor cold working such as flattening or temper rolling may be performed after the final solution annealing treatment.

NOTE 1—This recommended solution-anneal consists of heating to a minimum temperature of 1975°F (1080°C) and cooling rapidly to room temperature.

6. Chemical Composition

6.1 The material sampled in accordance with 10.2 shall conform to the composition limits prescribed in Table 1.

6.2 If a product analysis is subsequently made, the material shall conform to the composition limits with the product analysis variation prescribed Specification B880.

7. Mechanical Properties

7.1 The material shall conform to the requirements as to the mechanical property prescribed in Table 2.

8. Dimensions and Permissible Variations

8.1 Sheet—Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification B906, except as specified in Table 3 and Table 4.

8.2 Cold-Rolled Strip—Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification B906, except as specified in Tables 5-7.

8.3 Plate—Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification B906.
9. Sampling

9.1 Sampling for Chemical Analysis, Mechanical Testing, and Corrosion Testing shall be performed in accordance with Specification B906, except as specified herein:

9.1.1 Plate—A lot of plate for testing and inspection purposes shall consist of the products resulting from the rolling of one heat of material in the same condition and specified thickness, solution annealed by the same practice, but in no case more than 25 000 lb (11 340 kg).

9.1.2 Sheet and Strip—A lot of sheet or strip for testing and inspection purposes shall consist of material from one heat in the same form (sheet or strip), condition, finish, and specified thickness, solution-annealed by the same practice but in no case more than 25 000 lb (11 340 kg).

9.2 Sampling for Mechanical Tests:

9.2.1 When samples are to be taken after delivery, the purchaser of material ordered to cut lengths may request on the purchase order additional material of adequate size to provide sample coupons for inspection purposes.

10. Number of Tests and Retests

10.1 In the case of sheet or strip supplied in coil form, two or more tension tests (one from each end of each coil), and one or more hardness tests shall be made on specimens taken from each end of the coil. When material is supplied in flatsheet, flat strip, or plate, one tension and one or more hardness tests shall be made on each 100 or less sheets, strips, or plates of the same lot. When specified, one corrosion test shall be conducted for each lot.

10.2 If any specimens selected to represent any lot fail to meet any of the test requirements, the material represented by such specimens may be retested. If there is valid reason to believe the result is not representative, the material may be re-annealed and retested.

11. Specimen Preparation

11.1 Tension test specimens from material under ½ in. (12.7 mm) in thickness shall be of the full thickness of the material and machined to the form and dimensions shown for the sheet-type specimen in Test Methods E8/E8M. Tension test specimens from material ½ in. (12.7 mm) and over shall be of the full thickness of the material, machined to the form and dimensions shown for the plate-type specimen in Test Methods E8/E8M. Tension test specimens shall be taken from material after final heat treatment and shall be selected in the transverse direction unless prohibited by width.

12. Keywords

12.1 N08028; plate; sheetstrip
### TABLE 2 Mechanical Property Requirements

<table>
<thead>
<tr>
<th>Form</th>
<th>Tensile Strength, min, ksi (MPa)</th>
<th>Yield Strength (0.2 % offset), min, ksi (MPa)</th>
<th>Elongation in 2 in. or 50 mm, or 4D, min, %</th>
<th>Rockwell Hardness (or equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet</td>
<td>73 (500)</td>
<td>31 (214)</td>
<td>40</td>
<td>70–90 HRB</td>
</tr>
<tr>
<td>Strip</td>
<td>73 (500)</td>
<td>31 (214)</td>
<td>40</td>
<td>70–90 HRB</td>
</tr>
<tr>
<td>Plate</td>
<td>73 (500)</td>
<td>31 (214)</td>
<td>40</td>
<td>70–90 HRB</td>
</tr>
</tbody>
</table>

^ Hardness values are shown for information only and shall not constitute a basis for acceptance or rejection as long as the other mechanical properties are met.

### TABLE 3 Flatness Tolerances for Hot-Rolled and Cold-Rolled Sheets

<table>
<thead>
<tr>
<th>Specified Thickness, in. (mm)</th>
<th>Width, in. (mm)</th>
<th>Flatness Tolerance (max Deviation from a Horizontal Flat Surface), in. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.062 (1.57) and over</td>
<td>to 60 (1524), incl</td>
<td>½ (12.7)</td>
</tr>
<tr>
<td></td>
<td>over 60 to 72 (1524 to 1829), incl</td>
<td>¼ (19.1)</td>
</tr>
<tr>
<td></td>
<td>over 72 (1829)</td>
<td>1 (25.4)</td>
</tr>
<tr>
<td>Under 0.062 (1.57)</td>
<td>to 36 (914), incl</td>
<td>½ (12.7)</td>
</tr>
<tr>
<td></td>
<td>over 36 to 60 (914 to 1524), incl</td>
<td>¼ (19.1)</td>
</tr>
<tr>
<td></td>
<td>over 60 (1524)</td>
<td>1 (25.4)</td>
</tr>
</tbody>
</table>

### TABLE 4 Weight Tolerances for Hot-Rolled and Cold-Rolled Sheets

It is not practicable to produce hot-rolled and cold-rolled sheets to exact theoretical weight. Sheets of any one item of a specified thickness and size in any finish may be overweight to the following extent:

1. An item of five sheets or less, or an item estimated to weigh 200 lb (90.7 kg) or less, may actually weigh as much as 10 % over the theoretical weight.
2. An item of more than five sheets and estimated to weigh more than 200 lb (90.7 kg) may actually weigh as much as 7½ % over the theoretical weight.
3. The underweight variations for sheets are limited by the under thickness tolerances shown in Table 3 of Specification B906.

For determining theoretical weight, the factor 42 lb/ft^2·in. (0.0008 kg/cm²·mm) thickness may be used.
### TABLE 5 Thickness Tolerance\(^{A, B, C}\) for Cold-Rolled Strip for the Thicknesses and Widths Given, Over and Under Specified Thickness

| Specified Thickness | Over 0.160 to less than 0.187 | Over 0.099 to 0.160, incl | Over 0.069 to 0.099, incl | Over 0.049 to 0.069, incl | Over 0.039 to 0.049, incl | Over 0.034 to 0.039, incl | Over 0.028 to 0.034, incl | Over 0.025 to 0.028, incl | Over 0.019 to 0.025, incl | Over 0.016 to 0.019, incl | Over 0.012 to 0.016, incl | Over 0.011 to 0.012, incl | Over 0.010 to 0.011, incl | 0.010 |
|---------------------|-------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Width, in.          | 0.187                         | 0.022                       | 0.002                       | 0.002                       | 0.002                       | 0.002                       | 0.001                       | 0.001                       | 0.001                       | 0.001                       | 0.001                       | 0.001                       | 0.001                       | 0.001                       | 0.001                       | 0.001                       |
| Thickness, in.      | 0.002                         | 0.003                       | 0.004                       | 0.004                       | 0.004                       | 0.004                       | 0.005                       | 0.005                       | 0.005                       | 0.006                       | 0.006                       | 0.006                       | 0.006                       | 0.006                       | 0.006                       | 0.006                       | 0.006                       |

\(^{A}\) For thickness under 0.010 to 0.005 in. (0.254 to 0.127 mm), inclusive, in widths up to and including 16 in. (406 mm), a tolerance of ±10 % of the thickness applies. For thicknesses under 0.010 to 0.005 in. (0.254 to 0.127 mm), inclusive, in widths over 16 to 24 in. (406 to 610 mm), exclusive, a tolerance of ±15 % of the thickness applies. For thickness tolerances on thicknesses under 0.005 in. (0.127 mm) in widths up to 24 in. (610 mm), exclusive, the producer should be consulted.

\(^{B}\) Thickness measurements are taken \(\frac{3}{8}\) in. (9.5 mm) in from the edge of the strip, except that on widths less than 1 in. (25.4 mm) the tolerances are applicable for measurements at all locations.

\(^{C}\) The tolerances in this table do not include crown tolerances.

### TABLE 6 Crown Tolerances for Cold-Rolled Strip

<table>
<thead>
<tr>
<th>Specified Thickness, mm</th>
<th>4.76 to 25.4, incl</th>
<th>Over 25.4 to 76.2, incl</th>
<th>Over 76.2 to 152.4, incl</th>
<th>Over 152.4 to 228.6, incl</th>
<th>Over 228.6 to 304.8, incl</th>
<th>Over 304.8 to 406.4, incl</th>
<th>Over 406.4 to 508, incl</th>
<th>Over 508 to 609.6, incl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness, mm</td>
<td>0.005</td>
<td>0.005</td>
<td>0.008</td>
<td>0.008</td>
<td>0.008</td>
<td>0.008</td>
<td>0.010</td>
<td>0.010</td>
</tr>
</tbody>
</table>

\(^{A}\) A tolerance of ±10 % of the thickness applies. For thicknesses over 0.065 to 0.187 in. (1.65 to 4.76 mm), a tolerance of ±0.005 in. (0.13 mm) applies. For thicknesses over 0.187 to 0.48 in. (4.76 to 12.19 mm), inclusive, in widths over 24 in. (610 mm), exclusive, a tolerance of ±0.010 in. (0.25 mm) applies.

\(^{B}\) The tolerances in this table do not include crown tolerances.

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<table>
<thead>
<tr>
<th>Specified Length, ft (mm)</th>
<th>Tolerance Over Specified Length (No Under Tolerance), in. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>To 5 (1524), incl</td>
<td>3⁄8 (9.5)</td>
</tr>
<tr>
<td>Over 5 to 10 (1520 to 3050), incl</td>
<td>1⁄2 (12.7)</td>
</tr>
<tr>
<td>Over 10 to 20 (3050 to 6100), incl</td>
<td>3⁄8 (15.9)</td>
</tr>
</tbody>
</table>