Standard Specification for
UNS N06002, UNS N06230, UNS N12160, and UNS R30556
Plate, Sheet, and Strip¹

This standard is issued under the fixed designation B 435; 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 (e) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification² covers alloys UNS N06002, UNS
N06230, UNS N12160, and UNS R30556* in the form of
rolled plate, sheet, and strip for heat-resisting and general
corrosive service.

1.2 The following products are covered under this specifi-
cation:

1.2.1 Sheet and Strip—Hot- or cold-rolled, annealed, and
descaled unless solution annealing is performed in an atmo-
sphere yielding a bright finish.

1.2.2 Plate—Hot-rolled, solution-annealed, and descaled.

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: 

B 906 Specification for General Requirements for Flat-
Rolled Nickel and Nickel Alloys Plate, Sheet, and Strip
E 527 Practice for Numbering Metals and Alloys (UNS)

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 plate, n—material ⅛ in. (4.76 mm) and over in
thickness.

3.1.2 sheet and strip, n—material under ⅛ in. (4.76 mm) in
thickness.

4. General Requirements

4.1 Material furnished under this specification shall con-
form to the applicable requirements of Specification B 906
unless otherwise provided herein.

5. Ordering Information

5.1 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:

5.1.1 Alloy,

5.1.2 Dimensions—Thickness (in decimals of an inch),
width, and length (inch or fraction of an inch),

5.1.3 Certification—State if certification or a report of test
results is required (Specification B 906, section on Material
Test Report and Certification),

5.1.4 Optional Requirement—Plate; state how plate is to be
cut (Specification B 906, Table titled Permissible Variations in
width and Length of Sheared, Torch-Cut, or Abrasive-Cut
Rectangular Plate),

5.1.5 Purchase Inspection—State which tests or inspections
are to be witnessed (Specification B 906, section on Inspec-
tion), and

5.1.6 Samples for Product (Check) Analysis—State whether
samples should be furnished (Specification B 906, section on
Sampling).

6. Chemical Composition

6.1 The material shall conform to the requirements as to
chemical composition prescribed in Table 1.

6.2 If a product (check) analysis is made by the purchaser,
the material shall conform to the requirements specified in
Table 1 and Specification B 906.
7. Mechanical Properties and Other Requirements

7.1 Tensile Properties—The material shall conform to the room temperature tensile properties prescribed in Table 2.

7.2 Grain Size for Sheet and Strip:
7.2.1 Annealed alloys UNS N06002, UNS N06230, and UNS R30556 sheet and strip shall conform to the grain size requirements given in Table 3.

7.2.2 Annealed alloy UNS N12160 shall conform to an average grain size of ASTM No. 5 or coarser.

8. Dimensions, Mass, and Permissible Variations
8.1 Weight—For calculations of mass or weight, the following densities shall be used:

<table>
<thead>
<tr>
<th>Alloy</th>
<th>Density (lb/in.³)</th>
<th>Density (g/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNS N06002</td>
<td>0.297</td>
<td>(8.23)</td>
</tr>
<tr>
<td>UNS N06230</td>
<td>0.324</td>
<td>(8.97)</td>
</tr>
<tr>
<td>UNS R30556</td>
<td>0.297</td>
<td>(8.23)</td>
</tr>
<tr>
<td>UNS N12160</td>
<td>0.292</td>
<td>(8.08)</td>
</tr>
</tbody>
</table>

8.2 Thickness:
8.2.1 Sheet and Strip—The thickness shall be measured with the micrometer spindle ⅜ in. (9.525 mm) or more from any edge for material 1 in. (25.4 mm) or over in width and at any place on material under 1 in. in width.

8.3 Length:
8.3.1 Sheet and Strip—Sheet and strip may be ordered to cut lengths, in which case a variation of ⅛ in. (3.175 mm) over the specified length shall be permitted, with a 0 minus tolerance.

8.4 Straightness:
8.4.1 The edgewise curvature (depth of chord) of flat sheet, strip, and plate shall not exceed the product of 0.05 in. multiplies by the length in feet (0.04 mm multiplied by the length in centimetres).

8.4.2 Straightness for coiled strip is subject to agreement between the manufacturer and the purchaser.

8.5 Squareness (Sheet)—For sheets of all thicknesses and widths of 6 in. (152.4 mm) or more, the angle between adjacent sides shall be 90° ± 0.15° (1/16 in. in 24 in. or 2.6 mm/m).

8.6 Flatness—Plate, sheet, and strip shall be commercially flat.

8.7 Edges:
8.7.1 Plates shall have sheared, abrasive-cut or plasma-torch-cut edges as specified.

8.7.2 Sheet and strip shall have sheared or slit edges.

9. Product Marking
9.1 Each plate, sheet, or strip shall be marked on one face 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.

9.2 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.

10. Keywords
10.1 plate; sheet; strip; UNS N06002; UNS N06230; UNS N12160; UNS R30556

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TABLE 1 Chemical Requirements

<table>
<thead>
<tr>
<th>Element</th>
<th>Composition Limits, %</th>
<th>UNS N06002</th>
<th>UNS N06230</th>
<th>UNS R30556</th>
<th>UNS N12160</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel</td>
<td>remainder</td>
<td>remainder</td>
<td>19.0–22.5</td>
<td>remainder</td>
<td>remainder</td>
</tr>
<tr>
<td>Iron</td>
<td>17.0–20.0</td>
<td>3.0 max</td>
<td>21.0–23.0</td>
<td>26.0–30.0</td>
<td></td>
</tr>
<tr>
<td>Chromium</td>
<td>20.5–23.0</td>
<td>20.0–24.0</td>
<td>2.0–3.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobalt</td>
<td>0.5–2.5</td>
<td>5.0 max</td>
<td>0.05–0.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molybdenum</td>
<td>8.0–10.0</td>
<td>1.0–3.00</td>
<td>2.5–4.0</td>
<td>1.0 max</td>
<td></td>
</tr>
<tr>
<td>Tungsten</td>
<td>0.2–1.0</td>
<td>13.0–15.0</td>
<td>0.05–0.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>0.05–0.15</td>
<td>0.25–0.75</td>
<td>0.20–0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silicon</td>
<td>1.00 max</td>
<td>0.30–1.00</td>
<td>1.5 max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>1.00 max</td>
<td>0.030 max</td>
<td>0.04 max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.04 max</td>
<td>0.015 max</td>
<td>0.015 max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfur</td>
<td>0.03 max</td>
<td>0.015 max</td>
<td>0.015 max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Columbium N6</td>
<td></td>
<td>0.30 max</td>
<td>1.0 max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tantalum</td>
<td></td>
<td>0.30–1.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td></td>
<td>0.50 max</td>
<td>0.10–0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zirconium</td>
<td></td>
<td>0.001–0.10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lanthanum</td>
<td></td>
<td>0.005–0.050</td>
<td>0.005–0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td></td>
<td>0.10–0.30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boron</td>
<td></td>
<td>0.015 max</td>
<td>0.02 max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titanium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 2 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>N06002</td>
<td>95 (655)</td>
<td>35 (240)</td>
<td>35</td>
</tr>
<tr>
<td>N06230</td>
<td>110 (760)</td>
<td>45 (310)</td>
<td>40</td>
</tr>
<tr>
<td>R30556</td>
<td>100 (690)</td>
<td>45 (310)</td>
<td>40</td>
</tr>
<tr>
<td>N12160</td>
<td>90 (670)</td>
<td>35 (240)</td>
<td>40</td>
</tr>
</tbody>
</table>

A D refers to the diameter of the tension specimen.
B Solution annealed at a temperature between 2200 and 2275°F (1204 and 1246°C) followed by a water quench or rapidly cooled by other means.
C Solution annealed at 2100°F (1150°C) minimum.
D Solution annealed at 1950°F (1065°C) minimum.

TABLE 3 Grain Size for Annealed Sheet

<table>
<thead>
<tr>
<th>Thickness, in. (mm)</th>
<th>ASTM Micrograin Size Number, max</th>
<th>Average Grain Diameter, max, in. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.125 (3.175) and under</td>
<td>3.0</td>
<td>0.0500 (0.127)</td>
</tr>
<tr>
<td>Over 0.125 (3.175)</td>
<td>1.5</td>
<td>0.0094 (0.214)</td>
</tr>
</tbody>
</table>
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.