



Designation: B409 – 06 (Reapproved 2016)

# Standard Specification for Nickel-Iron-Chromium Alloy Plate, Sheet, and Strip<sup>1</sup>

This standard is issued under the fixed designation B409; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification<sup>2</sup> covers UNS N08120, UNS N08890, UNS N08800, UNS N08810, and UNS N08811<sup>3</sup> in the form of rolled plate, sheet, and strip. Alloy UNS N08800 is normally employed in service temperatures up to and including 1100°F (593°C). Alloys UNS N08120, UNS N08810, UNS N08811, and UNS N08890 are normally employed in service temperatures above 1100°F (593°C) where resistance to creep and rupture is required, and they are annealed to develop controlled grain size for optimum properties in this temperature range.

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 Safety Data Sheet (SDS) 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:<sup>4</sup>

**B408** Specification for Nickel-Iron-Chromium Alloy Rod and Bar

**B906** Specification for General Requirements for Flat-Rolled Nickel and Nickel Alloys Plate, Sheet, and Strip

**E140** Hardness Conversion Tables for Metals Relationship

<sup>1</sup> 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.

Current edition approved June 1, 2016. Published June 2016. Originally approved in 1957. Last previous edition approved in 2011 as B409 – 06 (2011). DOI: 10.1520/B0409-06R16.

<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications see related Specification SB 409 in Section II of that Code.

<sup>3</sup> New designations established in accordance with Practice E527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

<sup>4</sup> 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.

Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

**F155** Method of Test for Temper of Strip and Sheet Metals for Electronic Devices (Spring-Back Method) (Withdrawn 1982)<sup>5</sup>

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard*—The terms given in **Table 1** shall apply.

## 4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of Specification **B906** unless otherwise provided herein.

## 5. Ordering Information

5.1 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:

5.1.1 Alloy (**Table 2**),

5.1.2 Condition (*Temper*)—**Table 3** and **Table 4**, **Appendix X1**, and Specification **B906**.

5.1.3 Finish—**Appendix X1** and Specification **B906**.

5.1.4 Dimensions—Thickness, width, and length.

5.1.5 *Optional Requirements*:

5.1.5.1 *Sheet and Strip*—Whether to be furnished in coil, in cut straight lengths, or in random straight lengths.

5.1.5.2 *Strip*—Whether to be furnished with commercial slit edge, square edge, or round edge.

5.1.5.3 *Plate*—Whether to be furnished specially flattened (see **9.7.2**); also how plate is to be cut (Specification **B906**, **Table A3.4** and **Table A3.7**).

5.1.6 *Fabrication Details*—Not mandatory but helpful to the manufacturer:

5.1.6.1 *Welding or Brazing*—Process to be employed.

5.1.6.2 *Plate*—Whether material is to be hot-formed.

5.1.7 *Certification*—State if certification or a report of test results is required (Specification **B906**).

<sup>5</sup> The last approved version of this historical standard is referenced on www.astm.org.

**TABLE 1 Product Description**

Product	Thickness, in. (mm)	Width, in. (mm)
Hot-rolled plate <sup>A</sup>	3/16 and over (B906, Table A3.1 and Table A3.2)	(B906, Table A3.4) <sup>B</sup>
Hot-rolled sheet <sup>A</sup>	0.018 to 0.250 (0.46 to 6.4), incl (B906, Table A3.3)	(B906, Table A3.6)
Cold-rolled sheet <sup>C</sup>	0.018 to 0.250 (0.46 to 6.4), incl (B906, Table A3.3)	(B906, Table A3.6)
Cold-rolled strip <sup>C</sup>	0.005 to 0.250 (0.13 to 6.4), incl (B906, Table A3.3)	(B906, Table A3.6)

<sup>A</sup> Material 3/16 to 1/4 in. (4.8 to 6.4 mm), incl, in thickness may be furnished as sheet or plate provided the material meets the specification requirements for the condition ordered.

<sup>B</sup> Hot-rolled plate, in widths 10 in. (254 mm) and under, may be furnished as hot-finished rectangles with sheared or cut edges in accordance with Specification B408, provided the mechanical property requirements of this specification are met.

<sup>C</sup> Material under 48 in. (1219 mm) in width may be furnished as sheet or strip provided the material meets the specification requirements for the condition ordered.

**TABLE 2 Chemical Requirements**

Element	Composition Limits, %		
	Alloy N08120	Alloy N08890	Alloys N08800, N08810, and N08811
Nickel	35.0 min 39.0 max	40.0 min 45.0 max	30.0 min 35.0 max
Chromium	23.0 min 27.0 max	23.5 min 28.5 max	19.0 min 23.0 max
Iron	remainder <sup>A</sup>	remainder	39.5 min <sup>A</sup>
Manganese, max	1.5	1.5	1.5
Carbon	0.02 min 0.10 max	0.06 min 0.14 max	... ...
Copper, max	0.50	0.75	0.75
Silicon, max	1.0 ...	1.0 min 2.0 max	1.0 ...
Sulfur, max	0.03	0.015	0.015
Aluminum <sup>C</sup>	0.40 max ...	0.05 min 0.60 max	0.15 min 0.60 max
Titanium <sup>C</sup>	0.20 max ...	0.15 min 0.60 max	0.15 min 0.60 max
Columbium	0.4 min 0.9 max	... ...	... ...
Molybdenum	2.50 max ...	1.0 min 2.0 max	... ...
Niobium	... ...	0.2 min 1.0 max	... ...
Tantalum	... ...	0.10 min 0.60 max	... ...
Phosphorus	0.040 max	...	...
Tungsten	2.50 max	...	...
Cobalt, max	3.0	...	...
Nitrogen	0.15 min 0.30 max	... ...	... ...
Boron	0.010 max	...	...

<sup>A</sup> Iron shall be determined arithmetically by difference.

<sup>B</sup> Alloy UNS N08800: 0.10 max.

Alloy UNS N08810: 0.05–0.10.

Alloy UNS N08811: 0.06–0.10.

<sup>C</sup> Alloy UNS N08811: Al + Ti, 0.85–1.20.

5.1.8 *Samples for Product (Check) Analysis*—Whether samples for product (check) analysis should be furnished (see 7.2).

5.1.9 *Purchaser Inspection*—If purchaser wishes to witness tests or inspection of material at place of manufacture, the purchase order must so state indicating which tests or inspections are to be witnessed (Specification B906).

## 6. Materials and Manufacture

6.1 *Heat Treatment*—The final heat treatment of UNS N08120 shall be 2150°F (1177°C) minimum, UNS N08810, 2050°F (1121°C) minimum, UNS N08811 and UNS N08890, 2100°F (1149°C) minimum.

## 7. Chemical Composition

7.1 The material shall conform to the composition limits specified in Table 2.

7.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations in Specification B906.

## 8. Mechanical and Other Requirements

8.1 *Mechanical Properties*—The material shall conform to the mechanical properties specified in Table 3.

8.2 *Grain Size*—Annealed Alloys UNS N08120, UNS N08810, UNS N08811, and UNS N08890 shall conform to an average grain size of ASTM No. 5 or coarser.

8.3 *Deep-Drawing and Spinning Quality Sheet and Strip*—(Alloy UNS N08800) Shall conform to the grain size and hardness requirements as provided in Table 4.

8.3.1 The mechanical properties of Table 3 do not apply to deep drawing and spinning quality sheet and strip.

8.4 *Annealing Temperature*—Alloy UNS N08120 shall be annealed at 2150°F (1177°C) minimum, and UNS N08810, 2050°F (1121°C) minimum.

## 9. Dimensions and Permissible Variations

### 9.1 Thickness and Weight:

9.1.1 *Plate*—For plate up to 2 in. (50.8 mm), incl, in thickness, the permissible variation under the specified thickness and permissible excess in overweight shall not exceed the amounts prescribed in Table A3.1 in Specification B906.

9.1.1.1 For use with Table A3.1 in Specification B906, plate shall be assumed to weigh 0.287 lb/in.<sup>3</sup> (7.944 g/cm<sup>3</sup>).

9.1.2 *Plate*—For plate over 2 in. (50.8 mm) in thickness, the permissible variations over the specified thickness shall not exceed the amounts prescribed in Table A3.2 in Specification B906.

9.1.3 *Sheet and Strip*—The permissible variations in thickness of sheet and strip shall be as prescribed in Table A3.3 in Specification B906. The thickness of sheet and strip shall be measured with the micrometer spindle 3/8 in. (9.5 mm) or more from either edge for material 1 in. (25.4 mm) or over in width and at any place on strip under 1 in. in width.

### 9.2 Width or Diameter:

9.2.1 *Plate*—The permissible variations in width of rectangular plates and diameter of circular plates shall be as prescribed in Table A3.4 and Table A3.5 in Specification B906.