



Designation: B409 – 22

Standard Specification for Nickel-Iron-Chromium Alloy Plate, Sheet, and Strip¹

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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification² covers UNS N08120, UNS N08890, UNS N08800, UNS N08810, and UNS N08811³ 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 establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:⁴

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

¹ 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.

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

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

⁴ 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.

B906 Specification for General Requirements for Flat-Rolled Nickel and Nickel Alloys Plate, Sheet, and Strip
E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

3. General Requirements

3.1 Product furnished to this specification shall conform to the requirements of Specification B906 including any supplementary requirements indicated in the purchase order or contract. Failure to comply with the general requirements of Specification B906 constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification B906, this specification shall prevail.

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.

*A Summary of Changes section appears at the end of this standard

TABLE 1 Product Description

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

^A 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.

^B 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.

^C 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^A

Element	Composition Limits, %				
	Alloy N08120	Alloy N08890	Alloy N08800	Alloy N08810	Alloy N08811
Nickel	35.0 – 39.0	40.0 – 45.0	30.0 – 35.0	30.0 – 35.0	30.0 – 35.0
Chromium	23.0 – 27.0	23.5 – 28.5	19.0 – 23.0	19.0 – 23.0	19.0 – 23.0
Iron	remainder ^B	remainder	39.5 min ^B	39.5 min ^B	39.5 min ^B
Manganese	1.5	1.5	1.5	1.5	1.5
Carbon	0.02 – 0.10	0.06 – 0.14	0.10	0.05 – 0.10	0.06 – 0.10
Copper	0.50	0.75	0.75	0.75	0.75
Silicon	1.0	1.0 – 2.0	1.0	1.0	1.0
Sulfur	0.03	0.015	0.015	0.015	0.015
Aluminum	0.40	0.05 – 0.60	0.15 – 0.60	0.15 – 0.60	0.25 – 0.60 ^C
Titanium	0.20	0.15 – 0.60	0.15 – 0.60	0.15 – 0.60	0.25 – 0.60 ^C
Molybdenum	2.50	1.0 – 2.0	...	...	...
Niobium ^D	0.4 – 0.9	0.2 – 1.0	...	...	...
Tantalum	...	0.10 – 0.60	...	...	...
Phosphorus	0.040	...	0.045	0.045	0.045
Tungsten	2.50	...	...	...	...
Cobalt	3.0	...	...	...	...
Nitrogen	0.15 – 0.30	...	...	...	...
Boron	0.010	...	...	...	...

^A All values are maximums unless a range is provided.

^B Iron shall be determined arithmetically by difference.

^C Alloy N08811: Al + Ti = 0.85 – 1.20.

^D Columbium and Niobium are interchangeable names for the same element and both names are acceptable for use in B02.07 specifications.

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).

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 minimum temperature of the final heat treatment for each alloy shall be as follows:

6.1.1 UNS N08120—2150 °F (1177 °C);

6.1.2 UNS N08810—2050 °F (1121 °C); and

6.1.3 UNS N08811 and UNS N08890—2100 °F (1149 °C).

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.

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.³ (7.944 g/cm³).

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.