

ASTM B409 / ASME SB 409

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

This specification covers UNS N08120, UNS N08890, UNS N08800, UNS N08810, and UNS N08811 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.

A. General Requirements :-

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

B. Heat Treatment :-

1. 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.

C. Chemical Composition :-

The material shall conform to the composition limits specified in Table 1.

Table 1

Element	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 ^A	remainder	39.5 min ^A
Manganese, max	1.5	1.5	1.5
Carbon	0.02 min 0.10 max	0.06 min 0.14 max	^B ...
Copper, max	0.5	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 ^C	0.40 max ...	0.05 min 0.60 max	0.15 min 0.60 max
Titanium ^C	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	...	...

^A Iron shall be determined arithmetically by difference.

^B Alloy UNS N08800: 0.10 max.

Alloy UNS N08810: 0.05–0.10.

Alloy UNS N08811: 0.06–0.10.

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

D. Mechanical and Other Requirements :-

1. Mechanical Properties—

- i. The material shall conform to the mechanical properties specified in Table 2.

Table 2

Alloy	Condition	Tensile Strength, min, psi (MPa)	Yield Strength ^A (0.2 % offset), min, psi (MPa)	Elongation in 2 in. or 50 mm (or 4D), min, %
Hot-Rolled Plate				
UNS N08120	Annealed	90000 (621)	40000 (276)	30
UNS N08800	Annealed	75000 (520)	30000 (205)	30
UNS N08800	As-rolled ^{BC}	80000 (550)	35000 (240)	25
UNS N08810	Annealed	65000 (450)	25000 (170)	30
UNS N08811	Annealed	65000 (450)	25000 (170)	30
UNS N08890	Annealed	75000 (520)	30000 (205)	35
Hot-Rolled Sheet				
UNS N08120	Annealed	90000 (621)	40000 (276)	30
UNS N08800	Annealed	75000 (520)	30000 (205)	30
UNS N08810 ^D	Annealed	65000 (450)	25000 (170)	30
UNS N08811 ^D	Annealed	65000 (450)	25000 (170)	30
UNS N08890	Annealed	75000 (520)	30000 (205)	35
Cold-Rolled Sheet				
UNS N08120	Annealed	90000 (621)	40000 (276)	30
UNS N08800	Annealed	75000 (520)	30000 (205)	30
UNS N08810 ^D	Annealed	65000 (450)	25000 (170)	30
UNS N08811 ^D	Annealed	65000 (450)	25000 (170)	30
UNS N08890	Annealed	75000 (520)	30000 (205)	35
Cold-Rolled Strip				
UNS N08120	Annealed	90000 (621)	40000 (276)	30
UNS N08800	Annealed	75000 (520)	30000 (205)	30 ^E
UNS N08810 ^D	Annealed	65000 (450)	25000 (170)	30
UNS N08811 ^D	Annealed	65000 (450)	25000 (170)	30
UNS N08890	Annealed	75000 (520)	30000 (205)	35

^A Yield strength requirements do not apply to material under 0.020 in. (0.51 mm) in thickness.

^B As-rolled plate may be given a stress-relieving heat treatment subsequent to final rolling.

^C As-rolled plate specified “suitable for hot forming” shall be furnished from heats of known good hot-malleability characteristics. The purchaser must specify Alloy UNS N08800 or UNS N08810. There are no applicable tensile or hardness requirements for such material.

^D Available only in thicknesses 0.115 in. (2.92 mm) and over.

^E Not applicable for thickness under 0.010 in. (0.25 mm).

2. Grain Size—
 - i. Annealed Alloys UNS N08120, UNS N08810, UNS N08811, and UNS N08890 shall conform to an average grain size of ASTM No. 5 or coarser.
3. Deep-Drawing and Spinning Quality Sheet and Strip—
 - i. (Alloy UNS N08800) Shall conform to the grain size and hardness requirements as provided in Table 3.
 - ii. The mechanical properties of Table 2 do not apply to deep drawing and spinning quality sheet and strip.

Thickness	Calculated Diameter of Average Grain Section, max, in. (mm)	Corresponding ASTM Micro- Grain Size No.	Rockwell B ^{AB} Hardness, max
Sheet (56 in. (1.42 m) Wide and Under)			
0.050 (1.3) and less	0.0030 (0.075)	4.5	86
Over 0.050 to 0.250 (1.3 to 6.4), incl	0.0043 (0.110)	3.5	86
Strip (12 in. (305 mm) Wide and Under) ^C			
0.005 ^D to 0.010 (0.13 to 0.25), incl	0.0009 (0.022)	8 ^E	88 ^E
Over 0.010 to 0.125 (0.25 to 3.2), incl	0.0030 (0.075)	4.5	86

^A For Rockwell or equivalent hardness conversions see Hardness Conversion Tables E140.

^B Caution should be observed in using the Rockwell test on thin material, as the results may be affected by specimen thickness. For thicknesses under 0.050 in. (1.3 mm), the use of the Rockwell superficial or the Vickers hardness test is suggested.

^C Sheet requirements (above) apply to strip thicknesses over 0.125 in. (3.2 mm), and for all thicknesses of strip over 12 in. (305 mm) in width.

^D For ductility evaluations for strip under 0.005 in. (0.13 mm) in thickness, the spring-back test such as described in Test Method F155, is often used and the manufacturer should be consulted.

^E Accurate grain size and hardness determinations are difficult to make on strip under 0.005 in. (0.13 mm) in thickness and are not recommended.

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

E. Length :-

1. Sheet and strip of all sizes may be ordered to cut lengths, in which case a variation of 1/8 in. (3.18 mm) over the specified length shall be permitted.
2. Permissible variations in length of rectangular plate shall be as prescribed in Table A3.7 in Specification B906.

F. Test Methods :-

1. The chemical composition, mechanical, and other properties of the material as enumerated in this specification shall be determined, in case of disagreement, in accordance with the methods in Specification B906.

Related Keywords

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