

ASTM B407 / ASME SB407

SPECIFICATION FOR NICKEL-IRON-CHROMIUM ALLOY SEAMLESS PIPE AND TUBE

This specification covers UNS N08120, UNS N08800, UNS N08801, UNS N08810, UNS N08811, UNS N08890, and UNS N06811 in the form of cold-worked and hot-finished annealed seamless pipe and tube.

Alloys UNS N08800 and UNS N06811 are 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. 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, UNS N08890, 2100 °F (1149 °C) minimum, and UNS N06811, 1920 °F (1050 °C) minimum.

B. Chemical Composition :-

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

Table 1

Element	UNS N08120	UNS N08800, UNS N08810, and UNS N08811	UNS N08801	UNS N08890	UNS N06811
Nickel	35.0min	30.0min	30.0min	40.0min	38.0min
	39.0max	35.0max	34.0max	45.0max	46.0max
Chromium	23.0min	19.0min	19.0min	23.5min	27.0min
	27.0max	23.0max	22.0max	28.5max	31.0max
Iron	remainder	39.5min (A)	39.5min (A)	remainder	remainder
Manganese, max	1.5	1.5	1.5	1.5	2
Carbon	0.02min	(B)	0.10max	0.06min	0.03max
	0.10max	...	...	0.14max	...
Copper, max	0.5	0.75	0.5	0.75	0.60max
Silicon	1	1	1	1.0min	...
	...	...	...	2.0max	...
Sulfur, max	0.03	0.015	0.015	0.015	0.01
Aluminum (C)	0.40max	0.15min	...	0.05min	...
	...	0.60max	...	0.60max	...
Titanium (C)	0.20max	0.15min	0.75min	0.15min	...
	...	0.60max	1.50max	0.60max	...
Columbium	0.4min	...	...	...	...
	0.9max	...	...	...	...
Molybdenum	2.50max	...	...	1.0min	0.50min
	...	...	...	2.0max	1.50max
Niobium	...	...	...	0.2min	...
	...	...	...	1.0max	...
Tantalum	...	...	...	0.10min	...
	...	...	...	0.60max	0.030max
Phosphorus	0.040max	...	...	...	...
Tungsten	2.50max	...	...	...	...
Cobalt, max	3	...	...	...	...
Nitrogen	0.15min	...	...	...	0.10min
	0.30max	...	...	...	0.20max
Boron	0.010max	...	...	...	...

NOTES:

- (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.

C. Mechanical Properties and Other Requirements :-

- 1. Mechanical Properties—
 - i. The material shall conform to the mechanical properties specified in Table 2.

Table 2

Alloy	Condition (Temper)	Tensile Strength, min, psi (MPa)	Yield Strength, (0.2% offset), min, psi (MPa)	Elongation in 2 in. or 50 mm (or 4D), min, %
UNS N08120	hot-finished annealed or cold-worked annealed	90 000 (621)	40 000 (276)	30
UNS N08800	cold-worked annealed	75 000 (520)	30 000 (205)	30
UNS N08800	hot-finished annealed or hot-finished	65 000 (450)	25 000 (170)	30
UNS N08810 and UNS N08811	hot-finished annealed or cold-worked annealed	65 000 (450)	25 000 (170)	30
UNS N08801	hot-finished annealed or cold-worked annealed	65 000 (450)	25 000 (170)	30
UNS N08890	hot-finished annealed or cold-worked annealed	75 000 (520)	30 000 (205)	35
UNS N06811	hot-finished annealed or cold-worked annealed	85 000 (585)	35 000 (240)	30

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

- 3. Hydrostatic Test—
 - i. Each pipe or tube with an outside diameter 1/8 in. (3.2 mm) and larger, and tubes with wall thickness of 0.015 in. (0.38 mm) and over shall be tested by the manufacturer to an internal hydrostatic pressure of 1000 psi (6.9 MPa) provided that the fiber stress calculated in accordance with the following equation does not exceed the allowable fiber stress, S, indicated below. The pipe or tube shall show no evidence of leakage.

$$P = 2St/D$$

where: P = hydrostatic test pressure, psi (MPa),
 S = allowable fiber stresses, for material in the condition, as follows:

Cold-drawn annealed or hot-finished annealed alloy UNS N08120	22500 psi (155 MPa)
Cold-drawn annealed alloy UNS N08800 and all alloy UNS N08890	18700 psi (130 MPa)
Hot-finished as hot-finished, or hot-finished annealed, alloy UNS N08800	16600 psi (115 MPa)
Cold-drawn annealed or hot-finished annealed alloys UNS N08810, UNS N08811, and UNS N08801	16600 psi (115 MPa)
Cold-drawn annealed or hot-finished annealed alloy UNS N06811	21200 psi (145 MPa)

t = minimum wall thickness, in. (mm), equal to the specified average wall minus the permissible minus wall tolerance, Table 3, or the specified minimum wall thickness, and

D = outside diameter of the tube, in. (mm).

- ii. When so agreed upon between the manufacturer and purchaser, pipe or tube may be tested to 1(1/2) times the allowable fiber stress given in point C.3.i.
- 4. Eddy-Current Testing—
 - i. Testing shall be conducted in accordance with Practices E 426 or E 571.
- 5. Annealing Temperature—
 - i. Alloy UNS N08120 shall be annealed at 2150°F (1177°C) minimum, and UNS N08810 at 2050°F (1120°C) minimum.

D. Test Methods :-

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 following methods:

<u>Test Method</u>	<u>ASTM Designation</u>
Chemical Analysis	E 1473
Tension	E 8
Rounding Procedure	E 29
Rockwell Hardness	E 18
Grain Size	E 112
Hardness Conversion	E 140

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