

ASTM B670 / ASME SB670

Standard Specification for Precipitation-Hardening Nickel Alloy (UNS N07718) Plate, Sheet, and Strip for High-Temperature Service

This specification covers rolled precipitation hardenable nickel alloy (N07718) plate, sheet, and strip in the annealed condition (temper).

A. Chemical Composition :-

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

Table 1

Element	Composition, %	Product (Check) Analysis Variations, under min or over max, of the Specified Limit of Element
Carbon	0.08max	0.01
Manganese	0.35max	0.03
Silicon	0.35max	0.03
Phosphorus	0.015max	0.005
Sulfur	0.015max	0.003
Chromium	17-21	0.25
Cobalt ^A	1.0max	0.03
Molybdenum	2.8-3.3	0.1
Columbium (Nb) + tantalum	4.75-5.5	0.2
Titanium	0.65-1.15	0.05
Aluminum	0.2-0.8	0.1
Iron ^B	remainder	...
Copper	0.30max	0.03
Nickel	50-55	0.35
Boron	0.006max	0.002

^A If determined.

^B Iron shall be determined arithmetically by difference.

B. Mechanical and Other Requirements :-

1. *Tensile Properties*—The material after precipitation hardening shall conform to the tensile properties prescribed in Table 2.

Table 2: Tensile Properties for Plate, Sheet, and Strip^A

Nominal Thickness, in. (mm)	Tensile Strength min, ksi (MPa)	Yield Strength (0.2 % offset), min, ksi (MPa)	Elongation in 2 in. or 50 mm (or 4D), min, %
Up to 1.0 (25.4), incl	180 (1241)	150 (1034)	12
Over 1.0 to 2.25 (25.4 to 57.2), incl	180 (1241)	150 (1034)	10

^A Material shall be supplied in the annealed condition (temper). The manufacturer shall demonstrate that annealed material is capable of meeting the properties prescribed in Table 3 after precipitation heat treatment. Precipitation heat treatment shall consist of heating

to $1325 \pm 25^\circ\text{F}$ ($718 \pm 14^\circ\text{C}$), hold at temperature for 8 h, furnace cool to $1150 \pm 25^\circ\text{F}$ ($621 \pm 14^\circ\text{C}$), hold until total precipitation heat treatment time has reached 18 h, and then air cool.

2. *Stress-Rupture Properties*—The material after precipitation hardening shall conform to the stress-rupture properties prescribed in Table 3.

Table 3: Stress-Rupture Test at 1200°F (649°C) for Plate, Sheet, and Strip ^A

Nominal Thickness, in. (mm)	Stress, ^B ksi (MPa)	Life, min, h	Elongation in 2 in. or 50 mm (or 4D), min, %
Up to 0.015 (0.38), incl	95 (655)	23	...
Over 0.015 to 0.025 (0.38 to 0.64), incl	95 (655)	23	4
Over 0.025 to 1.5 (0.64 to 38.1), incl	100 (690)	23	4

^A Material shall be supplied in the annealed condition (temper). The manufacturer shall demonstrate that annealed material is capable of meeting the properties prescribed in Table 4 after precipitation heat treatment. Precipitation heat treatment is as specified in footnote ^A of Table 3.

^B Testing may be conducted at a stress higher than that specified but stress shall not be changed while test is in process. Time to rupture and elongation requirements shall be as specified in Table 4.

Testing may also be conducted using incremental loading. In such case, the stress specified in Table 4 shall be maintained to rupture or for 48 h, whichever occurs first. After the 48 h and at intervals of 8 to 16 h, preferably 8 to 10 h, thereafter, the stress shall be increased in increments of 5000 psi (34.5 MPa).

Time to rupture and elongation requirements shall be as specified in Table 4.

C. 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</u>	<u>ASTM Designation</u>
Chemical analysis	E 38, E 354 ^A
Tension	E 8
Rounding procedure	E 29
Stress rupture	E 139

^A Methods E 38 is to be used only for elements not covered by Test Methods E 354.

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