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Waspaloy® (UNS N07001) — Material Data Sheet

ASTM B637 · UNS N07001 · Waspaloy · W.Nr. 2.4654

Precipitation-hardening nickel-chromium-cobalt superalloy with Mo, Ti and Al

The gas-turbine superalloy for bolting that runs hotter than Inconel 718 can take: nickel-chromium-cobalt, age hardened by titanium and aluminium, 160 ksi tensile and stress-rupture rated at 1500 °F.

TENSILE, FULLY HEAT TREATED	160 ksi min	STRESS RUPTURE	33 ksi at 1500 °F, 100 h min
YIELD, FULLY HEAT TREATED	110 ksi min	CHROMIUM	18.00–21.00 %
HARDNESS	310 HBW min	COBALT	12.00–15.00 %

Nominal composition



Ni balance ~ 56.1% · Cr ~ 19.50% · Co ~ 13.50% · Mo ~ 4.25% · Ti ~ 3.00% · Al ~ 1.40% · Fe ~ 1.00% · Mn ~ 0.50% · C, Si, P, S, Zr, B, Cu trace

Midpoints of the specification ranges, for orientation only. Limits are in the table.

Chemical composition — Waspaloy (UNS N07001)

Element	Symbol	Min %	Max %
Carbon	C	0.03	0.10
Manganese	Mn	—	1.00
Silicon	Si	—	0.75
Phosphorus	P	—	0.030
Sulfur	S	—	0.030
Chromium	Cr	18.00	21.00
Cobalt	Co	12.00	15.00
Molybdenum	Mo	3.50	5.00
Titanium	Ti	2.75	3.25
Aluminium	Al	1.20	1.60
Zirconium	Zr	0.02	0.12
Boron	B	0.003	0.01
Iron	Fe	—	2.00
Copper	Cu	—	0.50
Nickel	Ni	balance	—

Values per ASTM B637-16 Table 1 (verified against the specification). Confirm the edition called out on your purchase order with our estimating team.

Physical properties (typical)

DENSITY	0.296 lb/in³ (8.20 g/cm³)
MODULUS OF ELASTICITY	30.9 × 10^6 psi (213 GPa)
THERMAL EXPANSION (70–800 °F)	7.6 µin/in·°F
MELTING RANGE	2425–2475 °F (1330–1360 °C)

Heat treatment

Solution treat at 1825–1900 °F for 4 hours and oil or water quench, stabilize at 1550 ± 25 °F for 4 hours and air cool, then age at 1400 ± 25 °F for 16 hours and air or furnace cool (B637 Table 2). B637 lists the condition as solution treated, stabilized and precipitation hardened.

Mechanical properties — Waspaloy (UNS N07001)

Condition	Tensile strength, min (ksi)	Yield strength 0.2% offset, min (ksi)	Elongation, min (%)	Reduction of area, min (%)	Hardness
Solution treated + stabilized + precipitation hardened	160	110	15	18	310 HBW min

Values per ASTM B637-16 Table 3 (verified against the specification), which marks the elongation and reduction-of-area figures with its note B, “Forgings”. Confirm the edition called out on your purchase order with our estimating team.

Stress-rupture requirement — Waspaloy per ASTM B637 Table 4

Test temperature	Stress (ksi)	Time to rupture, min (h)	Elongation, min (%)
1500 °F (816 °C)	33	100	5

Values per ASTM B637-16 Table 4 (verified against the specification). Confirm the edition called out on your purchase order with our estimating team.

Heat treatment — Waspaloy per ASTM B637 Table 2

Step	Cycle
Solution treatment (recommended)	1825–1900 °F (996–1038 °C), hold 4 h, oil or water quench
Stabilizing treatment (recommended)	1550 ± 25 °F (843 ± 14 °C), hold 4 h, air cool
Precipitation hardening	1400 ± 25 °F (760 ± 14 °C), hold 16 h, air cool or furnace cool

Values per ASTM B637-16 Table 2 (verified against the specification). Confirm the edition called out on your purchase order with our estimating team.

Applicable standards

ASTM B637	Precipitation-hardening nickel alloy bars, forgings and forging stock (UNS N07001, formerly Grade 685)
SAE AMS 5704 / 5706 / 5707 / 5708 / 5709	Aerospace specifications for Waspaloy rod, bar and forgings
W.NR. 2.4654	European material number

Forms we supply in Waspaloy

- Studs and stud bolts
- Hex, heavy hex and 12-point bolts
- Nuts and washers
- Machined components from certified bar

Typical applications

- Gas turbine case, flange and rotor bolting
- Turbine discs, shafts, rings and seals
- Aircraft engine and aerospace hot-section hardware
- Industrial gas turbine and power-generation fasteners
- High-temperature fasteners beyond the range of Inconel 718