

SOUTHERLY ALLOY

Inconel X-750 | UNS N07750 | Werkstoff Nr. 2.4669 | NiCr15Fe7TiAl | GH4145

ASTM B637 / ASME SB637; AMS 5542 / 5582 / 5583 / 5667 / 5698 — Precipitation-Hardenable Nickel Alloy, All Product Forms

Product Description

Inconel X-750 is a precipitation-hardenable nickel-chromium alloy carrying the UNS N07750 grade. Titanium, aluminum, and niobium together drive the strengthening reaction, so a solution treatment followed by aging near 704 °C develops the strength without any cold work. Nickel plus cobalt at 70.00% minimum keeps the matrix austenitic, and the Curie point sits far below zero, so the alloy stays essentially non-magnetic in service. The aged condition reaches 1170 MPa in bar and 1138 MPa in sheet, and the grade holds its shape under load where a lower-strength alloy would creep.

Chemical Composition

Element	Content (UNS N07750)	Element	Content (UNS N07750)
Nickel plus Cobalt (Ni + Co)	70.00% min.	Silicon (Si)	0.50% max.
Chromium (Cr)	14.00–17.00%	Copper (Cu)	0.50% max.
Iron (Fe)	5.00–9.00%	Cobalt (Co)	1.00% max.
Titanium (Ti)	2.25–2.75%	Carbon (C)	0.08% max.
Aluminum (Al)	0.40–1.00%	Tantalum (Ta)	0.05% max.
Niobium + Tantalum (Nb + Ta)	0.70–1.20%	Sulfur (S)	0.010% max.
Manganese (Mn)	1.00% max.		

ASTM B637, AMS 5542, AMS 5582, and AMS 5698 print one composition table for UNS N07750, and titanium, aluminum, and niobium together drive the precipitation reaction.

Minimum Room-Temperature Mechanical Properties

Product Form	Condition	Tensile Strength, min.	Yield Strength (0.2%), min.	Elongation, min.	Hardness
Bar and rod, ASTM B637 Type 2	Solution treated at 982 °C, aged	≥170 ksi (1170 MPa)	≥115 ksi (790 MPa)	18%	302–363 HB
Bar and rod, ASTM B637 Type 3	Solution treated at 1093 °C, aged	≥160 ksi (1103 MPa)	≥100 ksi (689 MPa)	20%	267–363 HB
Bar and rod, ASTM B637 Type 1	Solution treated at 1149 °C, stabilised, aged	≥140 ksi (965 MPa)	≥90 ksi (620 MPa)	8%	262 HB min.
Plate, AMS 5542	Annealed, then aged at 704 °C	≥155 ksi (1069 MPa)	≥100 ksi (689 MPa)	20%	Rc 30 min.
Sheet, AMS 5542	Annealed, then aged at 704 °C	≥165 ksi (1138 MPa)	≥105 ksi (724 MPa)	20%	Rc 32 min.
Strip, AMS 5542	Annealed, then aged at 704 °C	≥155 ksi (1069 MPa)	—	15%	Rc 30 min.
Seamless tube, AMS 5582	Solution treated, aged at 704 °C	≥155 ksi (1069 MPa)	≥100 ksi (689 MPa)	15%	—
Seamless tube, AMS 5583	Vacuum melted, solution treated, aged	≥170 ksi (1172 MPa)	—	—	—
No. 1 temper wire, AMS 5698	Cold drawn, aged at 732 °C	165–220 ksi (1138–1517 MPa)	—	—	—
Spring temper wire, AMS 5699	Cold drawn, aged at 649 °C	180–250 ksi (1241–1793 MPa)	—	—	—

ASTM B637 Table 3 prints the three bar Types separately, and the Type fixes the acceptance level rather than the section size. Flat product follows AMS 5542 and tubing follows AMS 5582 and AMS 5583, because no ASTM flat-rolled or tube document covers UNS N07750.

Physical Properties (typical values)

Property	Value
Density	Approx. 8.28 g/cm ³
Melting range	Approx. 1393–1427 °C
Curie temperature	Approx. –143 °C hot rolled; –125 °C fully heat treated
Modulus of elasticity / rigidity at 20 °C	Approx. 214 / 76 GPa; Poisson's ratio 0.29
Thermal conductivity at 20 °C	Approx. 12.0 W/m·K
Specific heat at 20 °C	Approx. 431 J/kg·K
Electrical resistivity at 20 °C	Approx. 1.22 μΩ·m
Thermal expansion, 20–100 °C	Approx. 12.6 μm/m·K
Strengthening route	Precipitation hardening only

Values are typical for the annealed condition at room temperature. The Curie point sits far below zero, so the alloy stays essentially non-magnetic in service.

Applicable Standards

Standard / Designation	Scope
ASTM B637 / ASME SB637	Bars, forgings, and forging stock for moderate or high temperature service
ASTM B880	General requirements for chemical analysis of nickel alloys
AMS 5667 / 5668 / 5669 / 5670 / 5671 / 5747	Bars, forgings, and rings by melting route, solution treatment, and heat treatment; consumable electrode or vacuum induction melted
AMS 5542	Plate, sheet, and strip, annealed
AMS 5598	Plate, sheet, and strip, remelted or vacuum induction melted
AMS 5582	Seamless tubing, precipitation hardenable to 1069 MPa
AMS 5583	Seamless tubing, vacuum melted, precipitation hardenable to 1172 MPa
AMS 5698 / AMS 5699	Wire in No. 1 temper and in spring temper
NACE MR0175 / ISO 15156-3	Sour service qualification where the order requires it
BS HR 505 / GE B14H41	British and gas turbine designations
UNS N07750 · W.Nr. 2.4669 · NiCr15Fe7TiAl; GB/T 14992 GH4145 · JIS NCF 750	Material and national designations
ASTM B168 / ASTM B163	These documents do not cover UNS N07750

The grade is welded with matching fillers under an inert gas shield, and the joint takes the same aging treatment as the parent metal.

Typical Supply Dimensions

Product Form	Typical Supply Range
Bar and rod	6–300 mm diameter to ASTM B637
Forged bar and forging stock	Sections above the agreed bar range, to ASTM B637
Seamless tube	Outside diameter 3.18–219 mm to AMS 5582
Wire	0.5–12 mm diameter in coils to AMS 5698 and AMS 5699
Plate, sheet, and strip	Plate 4.76–101.6 mm thick to AMS 5542; sheet and strip under 4.76 mm thick, sheet from 600 mm wide

Every range above follows the document that governs that form, and the aging cycle is quoted with the order because it fixes the mechanical level.

Surface Finishes

Surface Condition	Typical Use
Solution treated and pickled	Standard delivery for high-temperature service
Hot-worked	As-rolled or as-forged surface for parts that will be machined
Cold drawn	Close diameter control with a brighter surface
Peeled	Uniform diameter with a machined skin for further turning
Centerless ground	Tight diameter and straightness for shafting
Polished	Reduced roughness for product-contact and visible parts
Bright annealed	Scale-free surface for instrument and clean circuits

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