

SOUTHERLY ALLOY

Hastelloy B-3 | UNS N10675 | Werkstoff Nr. 2.4600 | NiMo29 | NS3203

ASTM B335 / B333 / B622 / B619 / B626 / B564 / B366 — Nickel-Molybdenum Alloy, All Product Forms

Product Description

Hastelloy B-3 is a nickel-molybdenum alloy carrying the UNS N10675 grade, with chromium held between 1 and 3 percent as a deliberate addition. That window slows the Ni4Mo ordering reaction which embrittles earlier B-type alloys, so a welded fabrication keeps far more of its ductility and usually enters service as welded. Hydrochloric, sulfuric, phosphoric, formic, and acetic acid all sit inside the envelope while the stream reduces, and nickel plus molybdenum runs 94.0 to 98.0%. The grade still refuses oxidants, and mid-temperature stress relief remains the wrong treatment.

Chemical Composition

Element	Content (UNS N10675)	Element	Content (UNS N10675)
Nickel (Ni)	65.0% min.	Molybdenum (Mo)	27.0–32.0%
Chromium (Cr)	1.0–3.0%	Iron (Fe)	1.0–3.0%
Tungsten (W)	3.0% max.	Cobalt (Co)	3.0% max.
Manganese (Mn)	3.0% max.	Carbon (C)	0.01% max.
Silicon (Si)	0.10% max.	Phosphorus (P)	0.030% max.
Sulfur (S)	0.010% max.	Vanadium (V)	0.20% max.
Aluminum (Al)	0.50% max.	Titanium (Ti)	0.20% max.
Copper (Cu)	0.20% max.	Columbium (Nb)	0.20% max.
Tantalum (Ta)	0.20% max.	Zirconium (Zr)	0.10% max.
Nickel plus Molybdenum (Ni + Mo)	94.0–98.0%		

Chromium between 1 and 3% is the deliberate addition that puts this grade ahead of earlier B-type alloys, and carbon at 0.01% supports it. ASTM B335 and B333 share this one table.

Minimum Room-Temperature Mechanical Properties

Standard / Form and Condition	Tensile Strength, min.	Yield Strength (0.2%), min.	Elongation / Hardness, min.
Rod, ASTM B335 – solution annealed, 7.94–88.9 mm	≥ 110 ksi (760 MPa)	≥ 51 ksi (350 MPa)	40%, 100 HRB max.
Plate, ASTM B333 – solution annealed, 4.76–63.5 mm	≥ 110 ksi (760 MPa)	≥ 51 ksi (350 MPa)	40%, 100 HRB max.
Sheet and strip, ASTM B333 – solution annealed, under 4.76 mm	≥ 110 ksi (760 MPa)	≥ 51 ksi (350 MPa)	40%, 100 HRB max.
Seamless tube, ASTM B622 – solution annealed, to 88.9 mm	≥ 110 ksi (760 MPa)	≥ 45 ksi (310 MPa)	40%, 100 HRB max.

Both grades carry identical acceptance minima, so nothing in this table separates them. B622 lowers the yield floor for seamless tube, and B619 pipe with B626 tube print their own acceptance tables. Neither grade responds to aging.

Physical Properties (typical values)

Property	Value
Density	Approx. 9.22 g/cm³
Melting range	Approx. 1370–1418 °C
Modulus of elasticity	Approx. 216 GPa
Modulus of rigidity	Approx. 83 GPa
Thermal conductivity at 20 °C	Approx. 11.2 W/m-K
Electrical resistivity at 20 °C	Approx. 1.37 µΩ-m
Thermal expansion, 25–100 °C	Approx. 10.6 µm/m-°C
Magnetic behaviour	Essentially non-magnetic in the annealed condition
Strengthening route	Cold work only

Typical room-temperature values from the published Haynes data for the grade. They support design work rather than acceptance testing. Specific heat is omitted because the two available sources disagree.

Applicable Standards

Standard / Designation	Scope
ASTM B335 / ASME SB335	Nickel-molybdenum alloy rod, 7.94–88.9 mm
ASTM B333 / ASME SB333	Plate, sheet, and strip in hot-rolled or cold-rolled condition
ASTM B622 / B619 / B626	Seamless tube to 88.9 mm outside dia.; welded pipe and welded tube
ASTM B564 / B366 / B462 / B472	Forgings and forged bar; wrought fittings; forged flanges and fittings; forging stock
DIN 17743 / 17750 / 17751 / 17752 / 17753 / 17754	Wrought nickel alloys by product form
ISO 6207 / 6208 / 9723 / 9724 / 9725	Tube, flat product, bar, wire, and forgings
UNS N10675 · W.Nr. 2.4600 · NiMo29 · GB/T 15007 NS3203	Material designations
SAE AMS	No aerospace specification covers this grade

Neither grade tolerates an oxidant, so ferric or cupric contamination and wet chlorine stay outside the envelope. Service temperature runs roughly –200 to +400 °C depending on load and medium. Solution annealing sits near 1066 °C (1950 °F) followed by a rapid water quench. Filler metal: ERNiMo-7 to AWS A5.14, or ENiMo-7 to AWS A5.11.

Typical Supply Dimensions

Product Form	Typical Supply Range	Length
Rod	7.94–88.9 mm dia. to ASTM B335	Cut to length or random
Forged bar	Above 88.9 mm dia., supplied to ASTM B564	Cut to length
Seamless tube	Outside diameter to 88.9 mm	Random, or cut to length
Welded pipe and tube	Schedule 5S through 80S and larger; tube 3.2–88.9 mm outside dia.	Random, or cut to length
Plate	4.76–63.5 mm thick to ASTM B333	Cut to length and width
Sheet and strip	Under 4.76 mm thick, from 600 mm wide or slit narrower	Coil, or cut to length

Rod sizes stop at 88.9 mm, where ASTM B335 ends, and larger sections ship as forged bar to ASTM B564.

Surface Finishes

Surface Condition	Typical Use
Solution annealed and pickled	Standard delivery for hydrochloric and sulfuric acid service
Hot-worked	Parts that will be machined to size
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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