

SOUTHERLY ALLOY

Hastelloy B-2 | UNS N10665 | Werkstoff Nr. 2.4617 | NiMo28 | NS322

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

Product Description

Hastelloy B-2 is a nickel-molybdenum alloy carrying the UNS N10665 grade, and chromium stays at 1.0% maximum while molybdenum runs 26.0–30.0%. That balance makes it the reference material for hydrochloric acid at every concentration and temperature, and it also covers sulfuric, phosphoric, acetic, and formic acid while the stream stays reducing. The same near-absence of chromium rules out oxidizing media, so nitric acid, wet chlorine, and ferric or cupric contamination sit outside the envelope. Mid-temperature exposure between 540 and 815 °C orders the metal into Ni4Mo and costs ductility permanently, which is why every lot is solution annealed and rapidly quenched.

Chemical Composition

Element	Content (UNS N10665)	Element	Content (UNS N10665)
Nickel (Ni)	Balance	Molybdenum (Mo)	26.0–30.0%
Iron (Fe)	2.0% max.	Chromium (Cr)	1.0% max.
Cobalt (Co)	1.00% max.	Manganese (Mn)	1.0% max.
Carbon (C)	0.02% max.	Silicon (Si)	0.10% max.
Phosphorus (P)	0.04% max.	Sulfur (S)	0.03% max.

Nickel makes up the balance of the melt. Iron and chromium stay low because together they drive Ni4Mo formation, which is the reaction this grade exists to avoid. The composition table is shared by ASTM B335 and B333, so one window governs every product form.

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.
Forgings, ASTM B564 – solution annealed	≥ 110 ksi (760 MPa)	≥ 51 ksi (350 MPa)	40%, 100 HRB max.

Both grades carry identical acceptance minima, so nothing in the mechanical table separates them. ASTM B564 lists one set of minima for rod, forgings, and flat product, and B622 lowers the yield floor for seamless tube. B619 welded pipe and B626 welded tube print their own acceptance tables, so we quote those figures from the edition named on the order. Neither grade responds to aging, so cold work is the only route above the annealed floor.

Physical Properties (typical values)

Property	Value
Density	Approx. 9.22 g/cm ³
Melting range	Approx. 1330–1380 °C
Modulus of elasticity	Approx. 217 GPa
Thermal conductivity at 0 °C	Approx. 11.1 W/m-K
Thermal conductivity at 100 °C	Approx. 12.2 W/m-K
Specific heat at 100 °C	Approx. 389 J/kg-K
Electrical resistivity at 20 °C	Approx. 1.37 μΩ-m
Thermal expansion, 20–93 °C	Approx. 10.3 μm/m-°C
Magnetic behaviour	Non-magnetic in the annealed condition
Strengthening route	Cold work only

Typical room-temperature values drawn from the published Haynes and mill data for the grade. They support design work rather than acceptance testing. The alloy has no aging response, so cold work sets every figure above the annealed minimum.

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 / ASME SB622	Seamless pipe and tube to 88.9 mm outside diameter
ASTM B619 / ASME SB619	Welded pipe, Schedule 5S through 80S and larger
ASTM B626 / ASME SB626	Welded tube, 3.2–88.9 mm outside diameter
ASTM B564 / ASME SB564	Nickel alloy forgings and forged bar beyond the rod range
ASTM B366 / ASME SB366	Factory-made wrought fittings
ASTM B462 / B472	Forged or rolled flanges and forged fittings; forging billets and bars
DIN 17743 / 17750 / 17751 / 17752 / 17753 / 17754	Wrought nickel alloys by product form – flat product, tube, bar, wire, forgings
ISO 6207 / 6208 / 9723 / 9724 / 9725	Tube, flat product, bar, wire, and forgings
UNS N10665 · W.Nr. 2.4617 · NiMo28 · GB/T 15007 NS322	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. No iron or copper may contact a hydrochloric acid circuit, because the salts that form attack the low-chromium matrix. Service temperature: exposure between 540 and 815 °C (1000–1500 °F) must be avoided in every case, because Ni4Mo ordering there costs ductility permanently. In oxidizing atmospheres such as air the ceiling is about 540 °C; in reducing gas or under vacuum the grade runs hotter. Solution annealing sits near 1065 °C (1950 °F) followed by a rapid water quench, and no stress-relief anneal applies at intermediate temperature. Filler metal: ERNiMo-7 to AWS A5.14, or ENiMo-7 electrodes 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	Schedule 5S through 80S, 8 in nominal and larger	Random, or cut to length
Welded tube	Outside dia. 3.2–88.9 mm × wall 0.41–3.7 mm	Random, or cut to length
Plate	4.76–63.5 mm thick to ASTM B333	Cut to length and width
Sheet	Under 4.76 mm thick, from 600 mm wide	Cut to length and width
Strip	Under 4.76 mm thick, under 600 mm wide	Coil, or cut to length

Rod sizes stop at 88.9 mm because that is where ASTM B335 ends; larger sections ship as forged bar to ASTM B564. Thickness and width together fix the product name, so an order has to state both. Coil delivery is a packaging choice and does not change the defined form.

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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