SOUTHERLY ALLOY

Alloy 20 | UNS N08020 | Werkstoff Nr. 2.4660 | NiCr20CuMo | NS1403

ASTM B463 / B473 / B729 / B464 / B468 / B462 / B366 — Nickel-Iron-Chromium Alloy, All Product Forms

Product Description

Alloy 20 is an austenitic nickel-iron-chromium alloy carrying the UNS N08020 grade, stabilised with niobium and alloyed with copper. Copper at 3.0–4.0% is what puts sulphuric and phosphoric acid within reach, and nickel at 32.0–38.0% removes chloride stress-corrosion cracking from the failure list. Niobium at eight times the carbon content ties carbon up as a stable carbide, so welded fabrications keep their corrosion resistance without a furnace cycle. Molybdenum at 2.0–3.0% adds localised-attack margin over 316L. Every product form shares one composition table and one stabilised annealed condition.

Chemical Composition

Element	Content (UNS N08020)	Element	Content (UNS N08020)
Nickel (Ni)	32.0–38.0%	Chromium (Cr)	19.0–21.0%
Copper (Cu)	3.0–4.0%	Molybdenum (Mo)	2.0–3.0%
Niobium (Nb + Ta)	8 × C min., 1.00% max.	Manganese (Mn)	2.00% max.
Silicon (Si)	1.00% max.	Carbon (C)	0.07% max.
Phosphorus (P)	0.045% max.	Sulfur (S)	0.035% max.
Iron (Fe)	Balance		

Copper is the deliberate addition behind the acid performance, and the niobium range scales with the carbon content at eight times carbon as a minimum. ASTM B463, B473, and B729 share this one composition table, so a single window governs every product form. The mill certificate governs final acceptance.

Minimum Room-Temperature Mechanical Properties

Standard / Form and Condition	Tensile Strength, min.	Yield Strength (0.2%), min.	Elongation / Hardness, min.
Plate, sheet, and strip, ASTM B463 – stabilised annealed	≥ 80 ksi (551 MPa)	≥ 35 ksi (241 MPa)	30%, 217 HB or 95 HRB max.
Bar, rod, and wire, ASTM B473 – stabilised annealed	≥ 80 ksi (551 MPa)	≥ 35 ksi (241 MPa)	30%, 217 HB or 95 HRB max.
Seamless pipe and tube, ASTM B729 – stabilised annealed	≥ 80 ksi (550 MPa)	≥ 35 ksi (240 MPa)	30%
Welded pipe, ASTM B464 – stabilised annealed	≥ 80 ksi (551 MPa)	≥ 35 ksi (241 MPa)	30%
Welded tube, ASTM B468 – stabilised annealed	≥ 80 ksi (551 MPa)	≥ 35 ksi (241 MPa)	30%
Forgings and forged flanges, ASTM B462 – stabilised annealed	≥ 80 ksi (551 MPa)	≥ 35 ksi (241 MPa)	30%

Every form carries one stabilised annealed condition, and ASTM B729 prints 80 and 35 ksi against 550 and 240 MPa where the other documents round those figures to 551 and 241 MPa. We keep each standard exactly as printed. Bar and forgings each add a 50% minimum reduction of area, and flat product under 0.38 mm takes a 20% elongation floor.

Physical Properties (typical values)

Property	Value
Density	Approx. 8.08 g/cm³
Melting range	Approx. 1385–1443 °C
Modulus of elasticity	Approx. 193 GPa
Shear modulus	Approx. 76 GPa
Thermal conductivity at 20 °C	Approx. 12.3 W/m·K
Electrical resistivity at 20 °C	Approx. 1.08 µΩ·m
Specific heat at 20 °C	Approx. 500 J/kg·K
Thermal expansion, 25–100 °C	Approx. 14.7 µm/m·°C
Magnetic response	Essentially non-magnetic
Strengthening route	Cold work only

Typical values from the published Special Metals data sheet for the grade, intended for design work rather than acceptance testing. Density is quoted at 8.08 g/cm³, and the melting range follows the same source.

Applicable Standards

Standard / Designation	Scope
ASTM B463 / ASME SB463	Plate, sheet, and strip
ASTM B473 / ASME SB473	Bar, rod, and wire
ASTM B729 / ASME SB729	Seamless pipe and tube
ASTM B464 / ASME SB464	Welded pipe
ASTM B468 / ASME SB468	Welded tube
ASTM B462 / B366 / B472	Forgings and forged flanges; wrought fittings; forging billets and bars
ASTM B906	Flat product thickness and width definitions
NACE MR0175 / ISO 15156-3	Sour service qualification for oil and gas
UNS N08020 · W.Nr. 2.4660 · NiCr20CuMo · GB/T 15007 NS1403	Material designations
SAE AMS	No aerospace specification covers this grade

Alloy 20 is stabilised with niobium, so most welded joints need no post-weld anneal and enter service as welded. Heat treatment differs by form: flat product and tubular product hold at 982–1010 °C, while bar holds at 927–1010 °C, and every route is water quenched or rapidly cooled. Filler metal: ER320LR to AWS A5.14, or E320LR to AWS A5.11.

Typical Supply Dimensions

Product Form	Typical Supply Range	Length
Bar and rod	6–300 mm diameter to ASTM B473	Cut to length or random
Forged bar	Sections above the agreed bar range, to ASTM B462	Cut to length
Seamless tube	Outside diameter 6–219 mm	Random, or cut to length
Welded pipe	NPS 1/8 to 6 in Schedule 5S, 10S, and 40S	Random, or cut to length
Welded tube	Outside diameter 3.2–88.9 mm	Random, or cut to length
Plate	4.76–63.5 mm thick to ASTM B463	Cut to length and width
Sheet and strip	Under 4.76 mm thick; sheet from 600 mm wide, strip narrower	Coil, or cut to length

ASME pressure-vessel rules allow service up to 538 °C, and the practical ceiling in dilute sulphuric acid sits far lower, near 93 °C.

Surface Finishes

Surface Condition	Typical Use
Stabilised annealed and pickled	Standard delivery for acid and chloride 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