SOUTHERLY ALLOY

Alloy 59 Bar and Rod | UNS N06059 | Werkstoff Nr. 2.4605 | NiCr23Mo16Al | NS3311

ASTM B574 / ASME SB574 — Nickel-Chromium-Molybdenum Alloy Bar, Rod, and Wire

Product Description

Alloy 59 bar and rod carries UNS N06059 from 6 to 300 mm diameter under ASTM B574, with diameters beyond the agreed range moving to the forging route. The low iron and silicon matrix gives shafts, valve trim, and machined parts a wider margin against chloride pitting than C-276 at the same duty. Every lot is solution annealed between 1100 and 1180 °C and water quenched, because a slow cool would let secondary phases form. Section shapes cover round, hex, square, flat, cold-drawn, and ground bar. The grade takes no aging treatment, so cold work sets yield above the annealed floor.

Chemical Composition

Element	Content (UNS N06059)	Element	Content (UNS N06059)
Nickel (Ni)	Balance	Chromium (Cr)	22.0–24.0%
Molybdenum (Mo)	15.0–16.5%	Iron (Fe)	1.5% max.
Aluminum (Al)	0.10–0.40%	Copper (Cu)	0.50% max.
Manganese (Mn)	0.50% max.	Cobalt (Co)	0.30% max.
Silicon (Si)	0.10% max.	Carbon (C)	0.010% max.
Phosphorus (P)	0.015% max.	Sulfur (S)	0.010% max.

Iron at 1.5% maximum and silicon at 0.10% maximum are the deliberate restraints behind the grade, and aluminium is the small deliberate addition. ASTM B574, B575, and B564 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, min.
Bar and rod, ASTM B574 – solution annealed	≥ 100 ksi (690 MPa)	≥ 45 ksi (310 MPa)	45%
Forged bar, ASTM B564 – solution annealed	≥ 100 ksi (690 MPa)	≥ 45 ksi (310 MPa)	45%

ASTM B574 sets one annealed condition across the bar and rod range, and B564 lists the same minima for forged bar beyond it. Bar above roughly 100 mm may be agreed at reduced minimum values, so state the ruling section on the enquiry. The grade takes no aging treatment.

Physical Properties (typical values)

Property	Value
Density	Approx. 8.6 g/cm³
Melting range	Approx. 1310–1360 °C
Modulus of elasticity	Approx. 210 GPa
Thermal conductivity at 20 °C	Approx. 10.4 W/m·K
Electrical resistivity at 20 °C	Approx. 1.26 µΩ·m
Specific heat at 20 °C	Approx. 414 J/kg·K
Thermal expansion, 20–100 °C	Approx. 11.9 µm/m·°C
Relative magnetic permeability at 20 °C	1.001 max.
Strengthening route	Cold work only

Typical values published for the grade, intended for design work rather than acceptance testing. The alloy stays essentially non-magnetic, which suits instrument assemblies in acid duty. Cold work is the only route above the annealed floor.

Applicable Standards

Standard / Designation	Scope
ASTM B574 / ASME SB574	Bar, rod, and wire in the solution-annealed condition
ASTM B564 / ASME SB564	Forgings and forging stock above the bar range
ASTM B472	Forging billets and bars for reforging
ASTM B575 / ASME SB575	Plate, sheet, and strip in the same grade
ASTM B622 / ASME SB622	Seamless pipe and tube in the same grade
ASTM B462 / ASME SB462	Forged or rolled flanges and forged fittings
ASTM B366 / ASME SB366	Factory-made wrought fittings
NACE MR0175 / ISO 15156-3	Sour service qualification for oil and gas
DIN 17752 / 17744	Bar, strip, and wire in the European system
VdTÜV 505	German pressure-equipment approval
UNS N06059 · W.Nr. 2.4605 · NiCr23Mo16Al · GB/T 15007 NS3311	Material designations
SAE AMS	No aerospace specification covers this grade

Alloy 59 has no aging response, so cold work sets every figure above the annealed floor, and welded joints usually enter service as welded. Solution annealing sits at 1100–1180 °C followed by a water quench, because the low silicon content makes secondary phases form quickly on a slow cool. Filler metal: ERNiCrMo-13 to AWS A5.14, or ENiCrMo-13 to AWS A5.11.

Typical Supply Dimensions

Product Form	Typical Supply Range
Round bar	6–300 mm diameter to ASTM B574
Round rod	6–25 mm diameter in coil or straight lengths
Bright bar	6–100 mm diameter, cold drawn and ground
Hex bar	8–60 mm across flats
Square bar	8–100 mm square
Flat bar	6–100 mm thick by 20–300 mm wide
Forged bar	200–1000 mm diameter to ASTM B564
Length	Random 3–6 m, or cut to the drawing

Sizes above the agreed bar range leave ASTM B574 and ship as forged bar to ASTM B564. Cut lengths carry the tolerance of the ordered condition.

Surface Finishes

Surface Condition	Typical Use
Solution 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