

SOUTHERLY ALLOY

Incoloy 825 Pipe and Tube | UNS N08825 | Werkstoff Nr. 2.4858 | NiCr21Mo

ASTM B423 / B163 / B704 / B705 — Seamless and Welded Tubular Product

Product Description

Incoloy 825 pipe and tube serves acid coolers, phosphoric acid evaporators, sour-service flowlines, and seawater-cooled exchangers. ASTM B423 governs seamless pipe and tube and is the only tubular standard in the grade that splits the anneal into a hot-finished level and a cold-worked level. B163 covers heat-exchanger tube to 3 in. (76.2 mm) outside diameter, and B704 with B705 covers welded product. Converter-size tube follows a separate appendix table with annealed, half-hard, and full-hard tempers. U-bent lengths, coiled tube, and heavy-wall pipe all quote against the same analysis.

Chemical Composition

Element	Content (UNS N08825)
Nickel (Ni)	38.0–46.0%
Chromium (Cr)	19.5–23.5%
Iron (Fe)	22.0% min. (balance)
Molybdenum (Mo)	2.5–3.5%
Copper (Cu)	1.5–3.0%
Titanium (Ti)	0.6–1.2%
Carbon (C)	0.05% max.
Manganese (Mn)	1.00% max.
Silicon (Si)	0.50% max.
Aluminium (Al)	0.20% max.
Sulfur (S)	0.03% max.

One composition row serves ASTM B423, B424, B425, B163, B704, and B705, because the grade has a single analysis window across every product form.

Minimum Room-Temperature Mechanical Properties

Standard / Form and Condition	Tensile Strength, min.	Yield Strength (0.2%), min.	Elongation, min.
B423 seamless pipe and tube – hot-finished, annealed	≥ 75 ksi (517 MPa)	≥ 25 ksi (172 MPa)	30%
B423 seamless pipe and tube – cold-worked, annealed	≥ 85 ksi (586 MPa)	≥ 35 ksi (241 MPa)	30%
B163 condenser and exchanger tube – annealed	≥ 85 ksi (586 MPa)	≥ 35 ksi (241 MPa)	30%
B705 welded pipe – annealed	≥ 85 ksi (586 MPa)	≥ 35 ksi (240 MPa)	30%
B704 welded tube – annealed	≥ 85 ksi (586 MPa)	≥ 35 ksi (240 MPa)	30%
B423 Table X1.1 converter-size tube – annealed	85–115 ksi (586–793 MPa)	≥ 35 ksi (241 MPa)	30%
B423 Table X1.1 converter-size tube – half-hard (No. 2 temper)	105 ksi (724 MPa) min.	≥ 75 ksi (517 MPa)	15%
B423 Table X1.1 converter-size tube – full-hard (No. 3 temper)	125 ksi (862 MPa) min.	≥ 100 ksi (689 MPa)	5%

B423 fixes an allowable fibre stress of 16,600 psi (114 MPa) for hot-finished annealed N08825 and 21,200 psi (146 MPa) for the cold-worked annealed condition, and B163 uses 21,000 psi (144.8 MPa). Hydrostatic testing covers tube with an outside diameter of 1/8 in. (3 mm) and over and a wall of 0.015 in. (0.38 mm) and over, and a flare test expands the tube end by 30% without cracking. Converter sizes apply below 1¼ in. (31.8 mm) outside diameter and exclude tube under 1/8 in. (3.2 mm) outside diameter with a wall under 0.015 in. (0.381 mm).

Physical Properties (typical values)

Property	Value
Density	Approx. 8.14 g/cm³
Melting range	Approx. 1370–1400 °C
Specific heat at 20 °C	Approx. 440 J/kg·K
Modulus of elasticity at 20 °C	Approx. 196 GPa
Thermal conductivity at 25 °C	Approx. 11.1 W/m·K
Thermal expansion, 20–100 °C	Approx. 14.1 µm/m·°C
Electrical resistivity at 25 °C	Approx. 1.13 µΩ·m
Curie temperature	Below –196 °C
Magnetic behaviour	Non-magnetic at ambient temperature

Typical room-temperature values from the Special Metals bulletin for the grade. They support design work rather than acceptance testing.

Applicable Standards

Standard / Designation	Scope
ASTM B423 / ASME SB423 (with B829)	Seamless pipe and tube for general corrosive service
ASTM B163 / ASME SB163	Seamless condenser and heat-exchanger tube, 3 in. (76.2 mm) outside dia. and under
ASTM B704 / ASME SB704 (with B751)	Welded tube
ASTM B705 / ASME SB705 (with B775)	Welded pipe
ASTM B564 / B366	Forgings for flanges and tube sheets, and wrought pipe fittings
ASME Code Case 1936	Nuclear construction – pipe and tube
NACE MR0175 / ISO 15156	Sour service, 35 HRC maximum in the annealed condition
BS 3074 (NA 16) · DIN 17751 / 17744	British and German seamless tube standards, and the German general wrought nickel standard
ISO 6207 · VdTUV 432	ISO seamless tube and pipe; German pressure-vessel material data sheet
UNS N08825 / W.Nr. 2.4858 / NiCr21Mo · JIS NCF 825	Material designations; Japanese designation

No aerospace material specification reaches this grade, so tube and pipe ship against the ASTM product standard named on the order. Service ceiling: about 540 °C (1000 °F) in continuous service, above which phase formation lowers ductility and impact strength. ASME Section VIII allowables stop at 800 °F (427 °C), and ASME Code Case 1936 covers nuclear pipe and tube. NACE MR0175 / ISO 15156 lists the grade in the solution-annealed condition at 35 HRC maximum. Filler metal: INCONEL Welding Electrode 112 for shielded metal-arc work, and INCONEL Filler Metal 625 for gas-shielded processes.

Typical Supply Dimensions

Product Form	Outside Diameter	Wall Thickness	Length
Seamless pipe	6–219 mm	Wall to 25 mm	Random or cut
Seamless exchanger tube	6–76 mm	0.5–3.76 mm	Random, U-bent, or cut
Welded pipe	10.3–762 mm	1.0–20 mm	Random or cut
Welded tube	1.6–101.6 mm	0.8–6.0 mm	Random, coil, or cut
Converter-size tube	3.2–31.8 mm	Per standard range	Straight or random
Heavy-wall tube	6–219 mm	3.76 mm and over	Random or cut

Cut lengths carry a plus tolerance of 1/8 in. (3.2 mm), and lengths over 30 ft (9.1 m) carry a plus tolerance of 1/4 in. (6.4 mm). U-bent bundles are made to your drawing rather than to a stock radius.

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