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ALLOY TECHNICAL DATA SHEET

ALLOY 625 NICKEL-CHROMIUM ALLOY

Nickel-Base Superalloy · UNS N06625

GENERAL PROPERTIES

Alloy 625 is an austenitic nickel-base superalloy known for resisting oxidation and corrosion across a broad range of conditions — from jet engine environments to chemical processing and seawater. It retains outstanding strength and toughness from cryogenic temperatures to 2000 °F (1093 °C) and has exceptional fatigue resistance.

Its strength comes from molybdenum and niobium (columbium) in solid solution in the nickel-chromium matrix. The same elements give excellent corrosion resistance: chromium and molybdenum resist chloride pitting and crevice attack, while the high nickel content resists chloride stress-corrosion cracking. It forms well, welds better than many highly alloyed nickel alloys and resists intergranular corrosion even as welded.

CHEMICAL COMPOSITION

Percent by weight, maximum unless range is specified — AMS 5599

Element	Alloy 625
Carbon	0.10
Manganese	0.50
Silicon	0.50
Phosphorus	0.015
Sulfur	0.015
Chromium	20.00–23.00
Molybdenum	8.00–10.00
Columbium (Niobium) + Tantalum	3.15–4.15
Iron	5.00
Cobalt	1.00
Titanium	0.40
Aluminum	0.40
Nickel	Remainder

MECHANICAL PROPERTIES

Minimum tensile properties — AMS 5599

Property	Value
Tensile strength, ksi (MPa)	120 (827)
0.2% Yield strength, ksi (MPa)	60 (414)
Elongation in 2" (50 mm) or 4D, %	30

The yield strength requirement does not apply under 0.020" (0.51 mm) nominal thickness, and the elongation requirement does not apply under 0.010" (0.25 mm).

Typical room-temperature properties

Condition	Tensile, psi (MPa)	0.2% Yield, psi (MPa)	Elong., %
Annealed 1920 °F	136,000 (940)	63,000 (430)	51.5
Solution annealed 2150 °F	115,500 (800)	49,500 (340)	67

Fatigue endurance limit, cold-rolled sheet in reversed bending: about 46,000 psi (315 MPa). Data are typical and do not necessarily represent minimum or maximum values. Each lot may vary.

PHYSICAL PROPERTIES

Melting range	2350–2450 °F (1288–1343 °C)
Density	0.305 lb/in^3 (8.44 g/cm^3)
Specific gravity	8.44
Modulus of elasticity (tension), 70 °F	29.8 × 10^6 psi (205 GPa)
Modulus of rigidity, 70 °F	11.4 × 10^6 psi (79 GPa)
Poisson's ratio, 70 °F	0.308
Electrical resistivity, 70 °F	128.9 microhm-cm

THERMAL PROPERTIES

Mean expansion from 70 °F (21 °C) to temperature shown

°F (°C)	Expansion, 10^{-6}/°F	Conductivity, Btu/hr·ft·°F	W/m·K
70 (21)	—	5.7	9.9
200 (93)	7.1	6.3	10.7
600 (316)	7.4	8.2	14.2
1000 (538)	7.8	10.1	17.5
1400 (760)	8.5	12.0	20.8
1600 (871)	8.8	13.2	22.8

CORROSION & OXIDATION RESISTANCE

High chromium and molybdenum give strong resistance to pitting and crevice corrosion in chloride media such as seawater, neutral salts and brines. In ATI's flowing-seawater testing, Type 316 showed crevice attack within one month while Alloy 625 showed none after 18 months. The alloy resists environments from highly oxidizing to moderately reducing and is highly resistant to chloride stress-corrosion cracking.

Oxidation and scaling resistance are excellent up to 2000 °F (1093 °C), and the alloy is superior to many other high-temperature alloys under cyclic heating and cooling.

FORMING

Alloy 625 can be formed like the standard austenitic stainless steels but is considerably stronger and work-hardens faster, so it requires higher forming loads and may need intermediate anneals for extensive cold work.

Values are typical or specification minimums as noted, provided for information only, and should not be used as design limits or as a guarantee of properties for any particular lot or application. Certified test reports are supplied with each order.

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