

431 Stainless Steel (UNS S43100) — Material Data Sheet

ASTM A276 bar · ASTM F593 bolts · UNS S43100 · AISI 431

High-strength nickel-bearing martensitic stainless steel

The strongest and most corrosion resistant of the common martensitic grades: 16 percent chromium with nickel, heat treatable to 220 ksi bolts, for marine shafts, pump parts and high-strength stainless fasteners.

HARDNESS, ANNEALED BAR	285 HBW max	CHROMIUM	15.0–17.0 %
BOLTS, F593 H	125–150 ksi	NICKEL	1.25–2.50 %
BOLTS, F593 HT	180–220 ksi	MAGNETIC	Yes

Nominal composition

■ Fe balance ~ 81.0% ■ Cr ~ 16.00% ■ Ni ~ 1.88% ■ Mn ~ 0.50% ■ Si ~ 0.50% ■ C, P, S trace

Midpoints of the specification ranges, for orientation only. Limits are in the table.

Chemical composition — Type 431 (UNS S43100)

Element	Symbol	Min %	Max %
Carbon	C	—	0.20
Manganese	Mn	—	1.00
Phosphorus	P	—	0.040
Sulfur	S	—	0.030
Silicon	Si	—	1.00
Chromium	Cr	15.0	17.0
Nickel	Ni	1.25	2.50

Values per ASTM A276/A276M-17 Tables 1 and 2 (verified against the specification). Confirm the edition called out on your purchase order with our estimating team.

Physical properties (typical)

DENSITY	0.280 lb/in ³ (7.75 g/cm ³)
MODULUS OF ELASTICITY	29.0 × 10 ⁶ psi (200 GPa)
THERMAL EXPANSION (68–212 °F)	5.5 µin/in·°F
MAGNETIC	Yes (martensitic)

Heat treatment

Hardened by austenitizing at 1875 °F minimum and oil quenching (A276 Table 3), and tempering: above 1050 °F for F593 Condition H, 400 to 700 °F for HT. Full annealing is difficult because of the nickel; bar is normally supplied tempered.

Bar properties — ASTM A276 Type 431

Condition and nominal diameter (in.)	Tensile strength, min (ksi)	Yield strength 0.2% offset, min (ksi)	Elongation, min (%)	Reduction of area, min (%)	Hardness
Condition A (annealed) — all	—	—	—	—	285 HBW max

Values per ASTM A276/A276M-17 Tables 1 and 2 (verified against the specification). Confirm the edition called out on your purchase order with our estimating team. A276 controls 431 bar by annealed hardness; hardened strengths are per F593 below.

Bolt and stud properties — ASTM F593 Alloy Group 6 (431)

F593 condition · marking	Nominal diameter (in.)	Tensile strength (ksi)	Yield strength, min (ksi)	Rockwell hardness
H (hardened, tempered ≥1050 °F) · F593S	¼ to 1½	125 to 150	100	C25 to C32
HT (hardened, tempered ≥525 °F) · F593T	¼ to 1½	180 to 220	140	C40 to C48

Values per ASTM F593-24 Table 2, full-size tests (verified against the specification). Yield is 0.2 % offset; hardness is Rockwell. Machined-specimen limits differ slightly.

Applicable standards

ASTM A276	Stainless steel bars and shapes
ASTM F593	Stainless steel bolts, hex cap screws and studs (Alloy Group 6)
ASTM A967	Passivation

Forms we supply in 431 Stainless

- Hex and heavy hex bolts and cap screws
- Full-thread studs and threaded rod
- Socket head cap and set screws
- Hex, jam and lock nuts
- Washers and spacers
- Machined components from certified bar

Typical applications

- Marine propeller and pump shafts
- High-strength stainless bolts and studs
- Aircraft and ground-support hardware
- Valve stems and actuator components
- Fasteners for seawater-splash zones where an austenitic grade is too weak