

416 Free-Machining Stainless Steel (UNS S41600) — Material Data Sheet

ASTM A582 bar · ASTM F593 bolts · UNS S41600 · AISI 416

Free-machining hardenable martensitic stainless steel

410 with sulfur added — the most machinable of all stainless steels, heat treatable to 190 ksi bolts, for turned pins, shafts, fittings and set screws.

HARDNESS, ANNEALED BAR	262 HBW max	BOLTS, F593 HT	160–190 ksi
HARDNESS, CONDITION T	248–302 HBW	MACHINABILITY	The best of any stainless
HARDNESS, CONDITION H	293–352 HBW	MAGNETIC	Yes

Nominal composition

■ Fe balance ~ 85.6% ■ Cr ~ 13.00% ■ Mn ~ 0.63% ■ Si ~ 0.50% ■ C, P, S trace

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

Chemical composition — Type 416 (UNS S41600)

Element	Symbol	Min %	Max %
Carbon	C	—	0.15
Manganese	Mn	—	1.25
Phosphorus	P	—	0.06
Sulfur	S	0.15	—
Silicon	Si	—	1.00
Chromium	Cr	12.0	14.0

Values per ASTM A582/A582M-22 Tables 1 and 3 (verified against the specification); free-machining grades are covered by A582, not A276. 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

Annealed, or hardened by quenching from 1700 to 1850 °F and tempered; A582 defines Conditions T and H by hardness (248 to 302 and 293 to 352 HBW) rather than by tempering temperature. The 700 to 1050 °F tempering range is avoided.

Bar properties — ASTM A582 Type 416

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	—	—	—	—	262 HBW max
Condition T (intermediate temper) — all	—	—	—	—	248 to 302 HBW
Condition H (hard temper) — all	—	—	—	—	293 to 352 HBW

Values per ASTM A582/A582M-22 Tables 1 and 3 (verified against the specification); free-machining grades are covered by A582, not A276. Confirm the edition called out on your purchase order with our estimating team. ASTM A582 controls free-machining bar by hardness; bolt strengths are per F593 below.

Bolt and stud properties — ASTM F593 Alloy Group 5 (410, 416, 416Se)

F593 condition · marking	Nominal diameter (in.)	Tensile strength (ksi)	Yield strength, min (ksi)	Rockwell hardness
H (hardened, tempered >=1050 °F) · F593P	¼ to 1½	110 to 140	90	C20 to C30
HT (hardened, tempered >=525 °F) · F593R	¼ to 1½	160 to 190	120	C34 to C45

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 A582	Free-machining stainless steel bars
ASTM F593	Stainless steel bolts, hex cap screws and studs (Alloy Group 5)
ASTM A967	Passivation

Forms we supply in 416 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

- Turned pins, shafts and spindles
- Fittings, plugs and adapters
- Set screws and small socket products
- Gears, bushings and hardened wear parts
- High-volume Swiss-machined stainless parts