

ASTM A193 Grade B16 — Material Data Sheet

ASTM A193 / ASME SA-193 · UNS K14072 · Cr-Mo-V alloy steel
Chromium-molybdenum-vanadium alloy steel, quenched and tempered

Vanadium-strengthened Cr-Mo bolting that holds its strength where B7 starts to relax — steam turbines, HP steam flanges and hot valve bonnets.

TENSILE (<=2½ IN.)	125 ksi min	HEAT TREATMENT	Q&T, 1200 °F min temper
YIELD (<=2½ IN.)	105 ksi min	COMPANION NUT	ASTM A194 4 or 7
HARDNESS	321 HBW / 35 HRC max	TYPICAL SERVICE	up to 1100 °F

Nominal composition

■ Fe balance ~ 96.9% ■ Cr ~ 0.97% ■ Mn ~ 0.57% ■ Mo ~ 0.57% ■ C, P, S, Si, V, Al trace

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

Chemical composition — ASTM A193 B16 (Cr-Mo-V, UNS K14072)

Element	Symbol	Min %	Max %
Carbon	C	0.36	0.47
Manganese	Mn	0.45	0.70
Phosphorus	P	—	0.035
Sulfur	S	—	0.040
Silicon	Si	0.15	0.35
Chromium	Cr	0.80	1.15
Molybdenum	Mo	0.50	0.65
Vanadium	V	0.25	0.35
Aluminum	Al	—	0.015

Values per ASTM A193/A193M-24, 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	0.284 lb/in ³ (7.85 g/cm ³)
MODULUS OF ELASTICITY	29.7 × 10 ⁶ psi (205 GPa)
THERMAL EXPANSION (68–212 °F)	6.8 µin/in·°F
MAGNETIC	Yes (ferromagnetic)

Heat treatment

Heated to 1700 to 1750 °F (925 to 955 °C), oil quenched, and tempered at 1200 °F (650 °C) minimum (A193 clause 6.1.7 and Table 2). Threads are formed after heat treatment where practical.

Mechanical properties — ASTM A193 B16

Nominal diameter (in.)	Tensile strength, min (ksi)	Yield strength 0.2% offset, min (ksi)	Elongation in 4D, min (%)	Reduction of area, min (%)	Hardness, max
2½ and under	125	105	18	50	321 HBW / 35 HRC
Over 2½ to 4	110	95	17	45	321 HBW / 35 HRC
Over 4 to 8	100	85	16	45	321 HBW / 35 HRC

Values per ASTM A193/A193M-24, Tables 1 and 2 (verified against the specification). Confirm the edition called out on your purchase order with our estimating team.

Applicable standards

ASTM A193 / ASME SA-193	Alloy-steel and stainless steel bolting for high-temperature or high-pressure service
ASTM A194 GRADES 4 AND 7	Companion heavy hex nuts for elevated temperature
ASME B16.5 / B16.47	Flange bolting — stud bolt lengths and quantities
ASME B31.1	Power piping

Forms we supply in A193 B16

- Full-thread studs and stud bolts
- Double-end and tap-end studs
- Hex and heavy hex bolts
- Socket head cap screws
- Threaded rod (cut and rolled thread)
- Machined components from certified bar

Typical applications

- Steam turbine casing and horizontal joint bolting
- High-pressure, high-temperature steam flanges
- Boiler and superheater valve bonnets
- Combined-cycle and cogeneration plants
- Hot hydrocarbon service in refineries
- Long-term creep-loaded joints