

ASTM A193 Grade B7M — Material Data Sheet

ASTM A193 / ASME SA-193 · UNS G41400 · G41420 · G41450 · AISI 4140 · 4142 · 4145

Chromium-molybdenum alloy steel, quenched and tempered to controlled hardness

B7 tempered to 22 HRC max for sour service — the NACE MR0175 bolting grade for wellheads, sour gas and H2S process piping.

TENSILE (<=4 IN.)	100 ksi min	HEAT TREATMENT	Q&T, 1150 °F min temper
YIELD (<=4 IN.)	80 ksi min	COMPANION NUT	ASTM A194 2HM
HARDNESS	235 HBW / 99 HRB max	SOUR SERVICE	NACE MR0175 / ISO 15156

Nominal composition

■ Fe balance ~ 97.3% ■ Cr ~ 0.95% ■ Mn ~ 0.88% ■ C, P, S, Si, Mo trace

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

Chemical composition — ASTM A193 B7M (Cr-Mo, AISI 4140/4142/4145)

Element	Symbol	Min %	Max %
Carbon	C	0.38	0.48
Manganese	Mn	0.75	1.00
Phosphorus	P	—	0.035
Sulfur	S	—	0.040
Silicon	Si	0.15	0.35
Chromium	Cr	0.80	1.10
Molybdenum	Mo	0.15	0.25

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. Table 1 footnote D permits 0.28 % minimum carbon for B7M (AISI 4130/4130H) where the tensile requirements are met; over 3½ in. carbon may be 0.50 % max.

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

Quenched in a liquid medium and tempered at 1150 °F (621 °C) minimum. Per clause 6.1.6 a final stress relief (or a substitute temper) is performed after all machining, cutting and forming at not less than 50 °F below the original tempering temperature; where the original temper was by induction above 1300 °F and the stress relief is in a furnace, the minimum is 1200 °F. Every piece is then hardness tested to the 235 HBW / 99 HRB maximum.

Mechanical properties — ASTM A193 B7M

Nominal diameter (in.)	Tensile strength, min (ksi)	Yield strength 0.2% offset, min (ksi)	Elongation in 4D, min (%)	Reduction of area, min (%)	Hardness, max
4 and under	100	80	18	50	235 HBW / 99 HRB (over 200 HBW / 93 HRB min)
Over 4 to 7	100	75	18	50	235 HBW / 99 HRB (over 200 HBW / 93 HRB min)

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. B7M: 100 percent hardness testing (S3) is available on request; 235 HBW / 99 HRB max, over 200 HBW / 93 HRB min.

Applicable standards

ASTM A193 / ASME SA-193	Alloy-steel and stainless steel bolting for high-temperature or high-pressure service
NACE MR0175 / ISO 15156	Materials for use in H2S-containing environments in oil and gas production
ASTM A194 GRADE 2HM	Companion controlled-hardness heavy hex nuts
API 6A	Wellhead and Christmas-tree equipment (bolting requirements)
ASME B16.5 / B16.47	Flange bolting — stud bolt lengths and quantities

Forms we supply in A193 B7M

- 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

- Sour gas wellhead and tree bolting
- H2S process piping and vessel flanges
- Amine, sulfur recovery and hydrotreating units
- Subsea and offshore production equipment
- Gas plants and compressor stations
- Any A193 B7 application where NACE compliance is called out