

ASTM F837 Stainless Steel Socket Head Cap Screws — Material Data Sheet

ASTM F837-20 · ASME B18.3 · UNS Group 1 S30400 family · Group 2 S31600 / S31603 · Group 5 S41000 · Group 1: 303, 304, 304L, 305, 384, XM1, 18-9LW, 302HQ, 304J3, Group 2: 316, 316L, Group 5: 410
Stainless socket head cap screws, austenitic Groups 1 and 2 (Conditions AF, CW, CW1) and martensitic Group 5 (Condition HT)

The stainless socket head cap screw specification: 304-group and 316-group alloys annealed or cold worked, or 410 hardened and tempered to 180 ksi, passivated and dimensioned to ASME B18.3 — the corrosion-resistant counterpart of A574.

ALLOYS	Group 1 (304 family) · Group 2 (316 / 316L) · Group 5 (410)	TENSILE, GROUP 5 HT (FULL SIZE)	180 ksi min
CONDITIONS	AF · CW · CW1 · HT (Group 5)	DIMENSIONS	ASME B18.3
TENSILE, CW (FULL SIZE)	80 ksi min	FINISH	Cleaned, descaled and passivated (A380 or A967)
TENSILE, CW1 (FULL SIZE)	102 ksi min		

Nominal composition

■ Fe balance ~ 69.9% ■ 18.0–20.0 ~ 17.00% ■ 8.0–10.5 ~ 9.00% ■ 2.00 ~ 2.00% ■ 1.00 ~ 1.00% ■ — ~ 1.00% ■ 0.08, 0.045, 0.030 trace

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

Chemical composition — ASTM F837-20 Table 2 (selected alloys)

Element	304 (Gr 1)	304L (Gr 1)	316 (Gr 2)	316L (Gr 2)	410 (Gr 5)
Carbon, max	0.08	0.030	0.08	0.03	0.15
Manganese, max	2.00	2.00	2.00	2.00	1.00
Phosphorus, max	0.045	0.045	0.045	0.045	0.040
Sulfur, max	0.030	0.030	0.030	0.030	0.030
Silicon, max	1.00	1.00	1.00	1.00	1.00
Chromium	18.0–20.0	18.0–20.0	16.0–18.0	16.0–18.0	11.5–13.5
Nickel	8.0–10.5	8.0–12.0	10.0–14.0	10.0–14.0	—
Molybdenum	—	—	2.0–3.0	2.0–3.0	—

Percent maximum unless a range is shown. Group 1 also includes 303 (free-machining, only with purchaser approval), 305, 384, XM1, 18-9LW, 302HQ and 304J3. Up to 1.00 % copper is permitted in 304, 304L and 305 at the manufacturer's option for formability.

Physical properties (typical)

DENSITY	0.289 lb/in ³ (8.00 g/cm ³), Groups 1 and 2
MODULUS OF ELASTICITY	28.0 × 10 ⁶ psi (193 GPa), Groups 1 and 2
THERMAL EXPANSION (68–212 °F)	9.6 μin/in·°F (304) · 8.9 μin/in·°F (316)
MAGNETIC	Groups 1 and 2: no when annealed (AF), slightly after cold work (CW, CW1) · Group 5 (410): yes

Heat treatment

Groups 1 and 2, Condition AF: annealed after manufacture at 1900 ± 50 °F and cooled fast enough to prevent carbide precipitation. CW and CW1: annealed, usually by the bar producer, then cold worked to strength. Group 5, Condition HT (410): austenitized at 1800 ± 50 °F for at least ½ h, air or oil quenched, tempered at 525 °F minimum for at least 1 h and air cooled.

Mechanical properties — ASTM F837-20 Table 1

Group · condition (nominal dia., in.)	Marking	Full-size tensile (ksi)	Extension, min	Machined tensile (ksi)	Yield 0.2 % (ksi)	Elongation, min (%)	Core hardness
Group 1 or 2 · AF (0.060–1.500)	F837A · F837D	85 max	0.60 D	85 max	55 max	40	210 HV max · 95 HRB max
Group 1 or 2 · CW (0.060–0.750)	F837B · F837E	80 min	0.40 D	80 min	40 min	25	150 HV min · 50 HRA min
Group 1 or 2 · CW1 (0.060–0.750)	F837C · F837F	102 min	0.40 D	87 min	65 min	20	220 HV min · 59 HRA min
Group 5 · HT (0.060–0.190)	F837G	180 min	—	—	—	—	350–423 HV · 36–43 HRC
Group 5 · HT (0.250–1.500)	F837H	180 min	0.20 D	160 min	120 min	12	350–423 HV · 36–43 HRC

Hardness is tested on every lot, plus either full-size tests (tensile and extension) or machined-specimen tests (tensile, yield, elongation); full-size results decide in arbitration. Core hardness applies only when full-size tensile testing cannot be done. CW and CW1 above 0.750 in.: properties and marking by agreement. D = nominal diameter.

Applicable standards

ASTM F837	Stainless steel socket head cap screws (inch)
ASTM F837M	Metric counterpart
ASME B18.3	Socket head cap screw dimensions
ASTM A262, PRACTICE E	Intergranular corrosion capability of Group 1 and 2 bar
ASTM A380 / A967	Cleaning, descaling and passivation
ASTM F606	Mechanical test methods
ASTM F788	Surface discontinuity limits
ASTM A574	Alloy steel equivalent

Forms we supply in F837

- Socket head cap screws, 0.060 in. (#0) to 1-1/2 in.
- Special lengths and drilled or cross-drilled heads
- 410 hardened and tempered screws (Group 5 HT)
- Machined specials to drawing

Typical applications

- Food, pharmaceutical and marine machinery
- Instrument and valve assembly
- Enclosures and washdown equipment
- Any socket-screw application where plated steel would corrode