

Duplex 2205 Stainless (UNS S31803 / S32205) — Material Data Sheet

ASTM A1082 bolting · ASTM A276 / A479 bar · ASTM A182 F51 / F60 · UNS S31803 · S32205 · 2205 duplex (22 Cr – 5 Ni – 3 Mo – N)
Ferritic-austenitic duplex stainless steel, solution annealed and water quenched

Twice the yield strength of 316 with far better chloride stress-corrosion resistance — the standard duplex for offshore, seawater and sour-service bolting.

TENSILE	90 ksi min (S31803) · 95 ksi (S32205)	SOLUTION ANNEAL	1900 °F, water quench
YIELD	65 ksi min	PREN	~ 35
HARDNESS	30 HRC / 290 HBW max	MAGNETIC	Yes (about half ferrite)

Nominal composition



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

Chemical composition — S32205 (2205) per ASTM A1082 Table 1

Element	Symbol	Min %	Max %
Carbon	C	—	0.030
Manganese	Mn	—	2.00
Phosphorus	P	—	0.030
Sulfur	S	—	0.020
Silicon	Si	—	1.00
Chromium	Cr	22.0	23.0
Nickel	Ni	4.5	6.5
Molybdenum	Mo	3.0	3.5
Nitrogen	N	0.14	0.20

Values per ASTM A1082/A1082M-16(2021) Tables 1 and 4 (verified against the specification). Confirm the edition called out on your purchase order with our estimating team.

Physical properties (typical)

DENSITY	0.283 lb/in ³ (7.80 g/cm ³)
MODULUS OF ELASTICITY	27.6 × 10 ⁶ psi (190 GPa)
THERMAL EXPANSION (68–212 °F)	7.2 µin/in·°F
MAGNETIC	Yes

Heat treatment

Solution annealed at 1900 ± 25 °F (1040 °C) and water quenched. Duplex grades are not hardened by heat treatment; they must not be held between 700 and 1800 °F, where sigma and other intermetallic phases form.

Mechanical properties — 2205 duplex bolting per ASTM A1082 Table 4

UNS	Tensile strength, min (ksi)	Yield strength, min (ksi)	Elongation, min (%)	Hardness, max
S31803	90	65	25	30 HRC / 290 HBW
S32205	95	65	25	30 HRC / 290 HBW

Values per ASTM A1082/A1082M-16(2021) Tables 1 and 4 (verified against the specification). Confirm the edition called out on your purchase order with our estimating team. Solution annealed at 1900 ± 25 °F and water quenched.

Chemical composition — S31803 per ASTM A1082 Table 1

Element	Symbol	Min %	Max %
Carbon	C	—	0.030
Manganese	Mn	—	2.00
Phosphorus	P	—	0.030
Sulfur	S	—	0.020
Silicon	Si	—	1.00
Chromium	Cr	21.0	23.0
Nickel	Ni	4.5	6.5
Molybdenum	Mo	2.5	3.5
Nitrogen	N	0.08	0.20

Values per ASTM A1082/A1082M-16(2021) Tables 1 and 4 (verified against the specification). Confirm the edition called out on your purchase order with our estimating team.

Applicable standards

ASTM A1082 / A1082M	High strength precipitation hardening and duplex stainless steel bolting
ASTM A276 / A479	2205 bar stock
ASTM A182 GRADES F51 / F60	Forged duplex flanges and fittings the bolting is matched to
NACE MR0175 / ISO 15156	Duplex stainless steels for sour service within their limits
NORSOK M-630 / MDS D45	Common offshore duplex bolting requirement

Forms we supply in Duplex 2205

- Full-thread studs and stud bolts
- Hex and heavy hex bolts
- Socket head cap screws
- Hex nuts in the same alloy
- Threaded rod
- Machined components from certified bar

Typical applications

- Offshore platform and subsea flange bolting
- Seawater cooling, firewater and desalination systems
- Sour gas and produced-water service
- Chemical process piping in chlorides
- Pulp and paper digesters and bleach plants
- Heat exchangers and pressure vessels in 2205