Duplex 2205

Grade 2205 is a duplex stainless steel with a mixed austenitic-ferritic microstructure, typically containing ~22% chromium, 5–6% nickel, and 3% molybdenum with nitrogen addition. It combines high mechanical strength with excellent corrosion resistance, particularly in chloride environments, making it a widely used alternative to 316 / 316L.

Standards & Designations

- **UNS**: S32205 / S31803
- **NACE**: ISO 15156 / MR0175 compliant
- **EN / W. Nr.**: 1.4462 / X2CrNiMoN22-5-3
- **ASTM/ASME**: A240 (plate), A276 (bars)

Corrosion Resistance: delivers excellent resistance to pitting, crevice corrosion, and stress corrosion cracking, significantly outperforming 304 and 316 grades. With a PREN value around 34–36, it is highly effective in chloride-containing environments such as seawater and chemical processing systems. It also provides strong resistance to organic and inorganic acids, particularly where chlorides are present.

Heat Treatment:

- **Solution annealing**: 1900–2050°F (1040–1120°C), followed by rapid cooling
- Maintains correct ferrite/austenite balance for optimal properties
- Cannot be hardened by heat treatment
- Cold working increases strength but may require re-annealing to restore ductility

Welding:

- **Machining**: More difficult than austenitic grades due to higher strength; requires rigid tooling and controlled speeds.
- **Forming**: Higher forming forces required compared to 316.
- **Welding**: Good weldability with controlled heat input; use **ER2209/E2209** fillers.

The list of applications for this general-purpose grade is very extensive and includes:

- Oil & gas (pipelines, separators)
- chemical processing equipment
- heat exchangers
- structural and industrial applications
- desalination plants
- pulp & paper industry
- marine and seawater handling components

A.I.S.I. Analysis	Grade	C	Mn	Si	P	S	Cr	Ni	Mo	N
	2205	.030 max	2.0 max	1.0 max	.030 max	.020 max	21.0 to 23.0	4.5 to 6.5	2.5 to 3.5	0.14 to 0.20

Typical Mechanical Properties - Annealed	Yield Strength .2% Offset psi	Ultimate Strength psi	Elongation % in 2″	Impact Charpy (ft. – lbs)	Elastic modulus (psi)
	65,000 - 80,000	90,000 - 116,000	20 - 25	~45 - 70	29×10^6 psi

Other Properties	Density (lb/in^3)	Melting Range	Electrical Resistivity at 68^0F ($\mu\Omega$-cm)	Thermal Expansion $32^0 – 212^0F$ ($In/In/^0F \times 10^{-6}$)
	0.278	2500–2640°F	27-30	7.2-7.8