410

410 is a hardenable, martensitic stainless steel containing ~12% chromium. It offers high strength and wear resistance with moderate corrosion resistance and remains magnetic in both annealed and heat-treated conditions. Typical uses include cutlery, fasteners, pump/valve components, and turbine parts.

Standards & Designations

- **UNS**: S41000
- **EN / W. Nr.**: 1.4006
- **AMS**: 5504 (sheet/plate)
- **ASTM/ASME**: A240/SA240 (plate, sheet, strip); A276/A479 (bars)

Corrosion Resistance: Performs well in atmospheric, fresh water, and weakly acidic environments (e.g., diluted acetic, nitric, sulfuric); also resistant to food acids. Susceptible to chloride attack in oxidizing conditions; not a substitute for 304/316 in aggressive chloride service. Maximum corrosion resistance is achieved in hardened and polished conditions.

Heat Treatment:

- **Full anneal**: 815–900 °C (1500–1650 °F); slow cool to ~600 °C (1100 °F) then air cool.
- **Process anneal**: 650–760 °C (1350–1450 °F); air cool.
- **Hardening**: 925–1010 °C (1700–1850 °F); air or oil quench (oil for heavy sections). Temper typically **200–400 °C** to target hardness; avoid **400–580 °C** to reduce embrittlement.

Welding:

- **Machining**: Readily machined in annealed or highly tempered states; machining difficulty increases above ~30 HRC (consider 416 for improved machinability if properties permit).
- **Forming**: Ductile and formable in annealed condition; avoid hot working below ~899 °C (1650 °F).
- **Welding**: Preheat ~150–260 °C (302–500 °F) recommended; post-weld anneal reduces cracking. Use E/ER410 fillers for matched properties, or 309/nickel-base fillers for ductility in as-welded joints.

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

- cutlery
- pump
- shafts and bushings
- blades
- valves parts
- steam/gas turbine components
- screws/bolts
- press plates
- petroleum refining equipment

A.I.S.I. Analysis	Grade	C	Mn	P	S	Si	Cr	Ni
	410	0.08–0.15	1.0 max	.04 max	.030 max	1.0 max	11.5–13.5	.075 max

Typical Mechanical Properties - Annealed	Yield Strength .2% Offset psi	Ultimate Strength psi	Elongation % in 2"	Hardness (Rb)	Elastic modulus (psi)
	30,000	65,000	20	80	$28.5–29 \times 10^6$ psi

Other Properties	Specific Heat (BTU/lb-°F)	Electrical Resistivity at 68^0F (μΩ-cm)	Poisson's Ratio	Specific Gravity
	0.11	55-60	0.27–0.30	7.7–7.8