321 / 321H

Type 321 is an austenitic stainless steel stabilized with titanium, designed to prevent carbide precipitation during exposure to temperatures in the 800–1500 °F range. This stabilization makes it highly resistant to intergranular corrosion, even after prolonged heating. It combines excellent oxidation resistance with good mechanical strength at elevated temperatures, making it suitable for high-temperature service in chemical, aerospace, and thermal processing industries

- **321:** Standard grade with low carbon content (≤ 0.08%), optimized for resistance to sensitization and intergranular corrosion during welding or short-term high-temperature exposure.

- **321H:** High-carbon variant (0.04–0.10%), specifically developed for improved creep strength and stress-rupture resistance during long-term service at temperatures above 1000 °F. This makes 321H the preferred choice for pressure vessels, furnace components, and other applications requiring durability under sustained high heat.

Corrosion Resistance: 321 and 321H stainless steels offer excellent resistance to intergranular corrosion due to titanium stabilization, which prevents carbide precipitation during exposure to temperatures in the 800–1500 °F range. This makes them suitable for environments where welded components or prolonged heating could otherwise lead to sensitization. Both grades also provide good resistance to general corrosion in mildly aggressive environments.

Heat Resistance: These grades maintain outstanding oxidation resistance and mechanical strength at elevated temperatures. They can withstand intermittent service up to about **1650 °F (900 °C)** and continuous service up to **1700 °F (925 °C)**. 321H, with its higher carbon content, delivers superior creep strength and stress-rupture resistance for long-term exposure above **1000 °F**, making it ideal for high-temperature pressure vessels and furnace components.

Heat Treatment:

- **Annealing/solution treatment:** heat to 950–1120 °C (1750–2050 °F), then rapid cooling.
- Optionally, stabilizing heat treat at ~870–890 °C (1600–1630 °F) after solution treatment for enhanced grain stability.

Welding: Both 321 and 321H are readily weldable using standard austenitic stainless steel fillers. Grade **321** minimizes carbide precipitation during welding, making it suitable for welded structures, while **321H** may require stabilization or post-weld heat treatment for critical high-temperature applications.

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

- automotive/aircraft exhaust manifolds
- high-temperature pressure vessels
- refinery equipment
- jet-engine parts
- chemical processing
- furnace components
- expansion joints
- heat exchangers

A.I.S.I. Analysis	Grade	C	Mn	P	S	Si	Cr	Ni
	321	.08 max	2.0 max	.045 max	.030 max	1.0 max	17.0 to 19.0	9.0 to 12.0
	321H	.04 – .10	2.0 max	.045 max	.030 max	1.0 max	17.0 to 19.0	9.0 to 12.0

Typical Mechanical Properties - Annealed	Yield Strength .2% Offset psi	Ultimate Strength psi	Elongation % in 2"	Hardness (Rb)	Impact Charpy ft. – lbs.	Modules of Elasticity in Tension - psi
	30,000	75,000	40	85 - 95	122	28×10^6

Other Properties	Creep Strength 1% Flow in 10,000 hrs at 1,000^{0}F psi	Magnetic Permeability at 200 H-Annealed	Electrical Resistivity Microhm – Cm at 68^{0}F	Thermal Expansion 32^0 – 212^{0}F (In/In/^{0}F×10^{-6})	Thermal Conductivity (BTU./ft.$_2$/hr./^{0}F/ft)
	12,500	1.02	29	9.28×10^{-6}	8.8 (at 68^{0}F)