

904L STAINLESS STEEL

Datasheet for Stainless Steel 904L

- Pipes & Tubes
- Sheets & Plates
- Bars & Rods, Forgings
- Fittings & Flanges
- Stainless steel profiles



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AISI 904L / UNS N08904 / DIN 1.4539

What is 904L Stainless Steel?

- 904L stainless steel is a high-alloy, corrosion-resistant austenitic stainless steel designed for use in highly aggressive environments. Known by its UNS designation N08904 and EN standard 1.4539 (X1NiCrMoCu25-20-5), 904L offers superior resistance to sulfuric acid, chloride-induced pitting, and crevice corrosion.
- If your project requires stainless steel that can withstand harsh chemical exposure or marine environments, 904L stainless steel is a premium choice. It combines durability, corrosion resistance, and long service life—ideal for industrial and high-end applications.

904L Stainless Steel Equivalent Standards Table (Pipe, Plate/Coil, Bar)

Product Type	ASTM Standards	JIS Equivalent	EN/DIN Numeric Designation	EN/DIN Symbolic Designation	UNS Number
Pipe	Seamless: ASTM B677, ASTM A312, ASTM A213, ASTM A269 Welded: ASTM A312, ASTM A358	JIS: QS 2025 MC	EN 1.4539	X1NiCrMoCu25-20-5	UNS N08904
Plate / Coil	ASTM A240, ASTM A480	JIS: QS 2025 MC	EN 1.4539	X1NiCrMoCu25-20-5	UNS N08904
Bar / Rod	ASTM A276, ASTM A479, ASTM B649	JIS: QS 2025 MC	EN 1.4539	X1NiCrMoCu25-20-5	UNS N08904

904L vs 316L Stainless Steel: Which One Should You Choose?

When choosing between 904L vs 316L stainless steel, it's essential to consider corrosion resistance, cost, and application suitability.

- First, in terms of corrosion resistance, 904L outperforms 316L in highly aggressive environments, especially where strong acids like sulfuric acid or chloride-rich seawater are present. This is due to its higher nickel (up to 28%) and the addition of copper, which enhances resistance to pitting and crevice corrosion.
- Second, regarding cost, 904L is significantly more expensive than 316L—not only due to its alloying elements but also because it is harder to machine and fabricate.
- Lastly, in terms of applications, 316L is commonly used in marine, food processing, and pharmaceutical industries, while 904L is reserved for demanding sectors like chemical processing, offshore oil & gas, and even luxury watchmaking where extreme corrosion resistance is critical.

904L stainless steel in watches

Yes, 904L stainless steel is famously used in Rolex watches. Unlike most luxury watchmakers who use 316L stainless steel, Rolex exclusively uses 904L stainless steel—branded as "Oystersteel"—for its superior corrosion resistance, exceptional polishability, and durability. 904L contains higher levels of nickel, chromium, molybdenum, and copper, giving it excellent resistance to sweat, saltwater, and daily wear, making it ideal for high-end timepieces that are both functional and luxurious. Its ability to maintain a high-gloss finish over time also makes it the perfect choice for Rolex's iconic appearance. While harder to machine and more expensive, Rolex's investment in 904L sets its watches apart in both engineering quality and visual brilliance.

Applications of Stainless Steel 904L

- Petroleum, petrochemical equipment, such as reactors in petrochemical equipment.
- National Defence
- Nuclear industry
- Aviation
- Power generation
- Wiring in electrostatic precipitators
- Oil refinery components
- Seawater cooling devices
- Gas scrubbing plants
- Pulp and paper processing industries
- Acetic, phosphoric and sulphuric acid processing plants
- Storage and transportation equipment for sulfuric acid, such as heat exchangers.
- Power plant flue gas desulfurization device, the main use parts are: tower body of the absorption tower, flue, door panel, internal parts, sprinkler system, etc.
- Washers and fans in organic acid treatment systems.

Properties, Limitations and Processing Characteristics of Stainless Steel 904L

Characteristics

- 904L is a high-alloy austenitic stainless steel with a very low carbon content. The steel is designed for harsh environments. The alloy was originally developed for corrosion resistance in dilute sulfuric acid. This feature has been proven to be very successful after many years of practical application. The 904L is now standardized in many countries and has been approved for the manufacture of pressure vessels.
- Like other commonly used CrNi austenitic steels, 904L alloy has good resistance to pitting corrosion and crevice corrosion, high resistance to stress corrosion cracking, good resistance to intergranular corrosion, good processability and Weldability. The maximum heating temperature for hot forging can reach 1180 degrees Celsius, and the minimum stop forging temperature is not less than 900 degrees Celsius. This steel thermoforming can be carried out at 1000--1150 degrees Celsius. The heat treatment process of the steel is 1100--1150 degrees Celsius, and is quickly cooled after heating.

Processing/Welding

- Welding of grade 904L stainless steels can be performed using all conventional methods. This grade does not require pre-heat and post-weld heat treatments. Grade 904L can be subjected to hot cracking in constrained weldment. Grade 904L electrodes and rods are used for welding grade 904L steels according to AS 1554.6.

904L Stainless Steel – Common Size Specifications

Product Form	Common Specifications	
Seamless Pipe / Tube	<ul style="list-style-type: none">• Outer Diameter (OD): 6 mm – 630 mm (0.25" – 24")• Wall Thickness: 0.5 mm – 30 mm• Length: Up to 12 meters (or custom)	
Welded Pipe / Tube	<ul style="list-style-type: none">• OD: 10 mm – 1219 mm (0.4" – 48")• Wall Thickness: 1 mm – 30 mm• Length: Standard 6 m or customized	
Sheet / Plate	<ul style="list-style-type: none">• Thickness: 0.5 mm – 100 mm (Cold/Hot rolled)• Width: Up to 2000 mm• Length: Up to 6000 mm	
Coil / Strip	<ul style="list-style-type: none">• Thickness: 0.3 mm – 6 mm• Width: 20 mm – 1500 mm• Coil ID: 508 mm or 610 mm	
Bar / Rod	<ul style="list-style-type: none">• Diameter: 6 mm – 300 mm (0.25" – 12")• Length: 1 m – 6 m (or cut-to-length)• Shapes: Round, Hex, Square	

Equivalents of Stainless Steel 904L

Standard	904L
UNS	N08904
Werkstoff Nr.	1.4539

Chemical, Mechanical & Physical Properties of Stainless Steel 904L

SS 904L Chemical Composition

C	≤0.020
Mn	≤2.00
P	≤0.045
S	≤0.035
Si	≤1.00
Cr	19.0-23.0
Ni	23.0-28.0
Mo	4.0-5.0
N	≤0.10
Cu	1.0-2.0

SS 904L Physical Properties

Grade	Density (kg/m ³)	Elastic Modulus (GPa)	Mean Co-eff of Thermal Expansion (μm/m/°C)			Thermal Conductivity (W/m.K)		Specific Heat 0-100°C (J/kg.K)	Elec Resistivity (nΩ.m)	Melting Point
			0-100°C	0-315°C	0-538°C	At 20°C	At 500°C			
904L										
	7900	190	15	-	-	11.5	-	500	952	1300-1390 °C

SS 904L Mechanical Properties

Grade	Tensile Strength (MPa) min	Yield Strength 0.2% Proof (MPa) min	Elongation (% in 50mm) min	Hardness	
				Rockwell B (HR B)	Brinell (HB)
904L					
	490	220	36	70-90 typical	150

904L Stainless Steel FAQ

How Corrosion-Resistant Is 904L Stainless Steel?

Sulfuric Acid Environments: At 50°C in 5% H₂SO₄, the corrosion rate of 904L is only 0.05 mm/year, which is 10 times lower than 316L (0.5 mm/year).

Seawater Corrosion: Withstanding chloride ions up to ~19,000 ppm, 904L's pitting resistance is three times higher than 316L, making it ideal for desalination systems and marine applications.

Stress Corrosion Cracking: In a 42% MgCl₂ solution at 150°C, 904L resists cracking for over 1000 hours, while 316L fails in less than 24 hours under the same conditions.

Why Is 904L Stainless Steel Much More Expensive Than Standard Grades?

- 1. Cost Drivers:** The high cost of 904L is primarily due to its alloy content, including nickel (25%+) and molybdenum (4%+), which together account for over 70% of the raw material cost—significantly higher than 316L (nickel ~10%, molybdenum ~2%).
- 2.** Although its initial cost is 2–3 times higher than 316L, 904L offers 3–5 times longer service life in highly corrosive environments, resulting in a lower total cost of ownership over time.

What Should Be Considered When Welding 904L Stainless Steel?

- 1. Filler Metal Selection:** Use only ER385 welding wire (specifically for 904L, containing ~29% Ni and ~3.5% Mo). Do not substitute with 316L wire, as it offers inadequate corrosion resistance for 904L base metal.
- 2. Post-Weld Treatment:** Post-weld annealing is generally not required. However, for pressure vessels or critical equipment, pickling and passivation is recommended to remove weld spatter and restore the passive film on the surface.

Is 904L Stainless Steel Safe for Food Contact?

Yes. 904L complies with FDA 21 CFR 177.2600 for food contact applications. When the surface roughness (Ra) is $\leq 1.6 \mu\text{m}$, it is suitable for pharmaceutical equipment and food-grade piping. However, it is recommended to avoid prolonged contact with high-concentration chlorides, such as soy sauce or brine, to maintain optimal performance.

How to Verify the Authenticity of 904L Stainless Steel?

Follow the "Three-Check Rule":

- 1. Check Certificates:** Require material test reports per ASTM A240 (plates) or ASTM A312 (pipes). Key chemical values: C \leq 0.02%, Ni \geq 23%, Mo = 4–5%.
- 2. Elemental Testing:** Use a handheld spectrometer to verify the Ni/Mo/Cu ratio (~25:4:1). Be cautious of low-nickel counterfeit grades.
- 3. Corrosion Testing:** Request intergranular corrosion testing per ASTM A262 Practice E. A weight loss of $\leq 0.5 \text{ g/m}^2$ indicates conformity.