

## Specification of Super Austenitic Stainless Steel (904L)

**UNS N08904**, also known as **Alloy 904L**, is a **super austenitic stainless steel** with excellent corrosion resistance, especially in **strong reducing acids**, such as **sulfuric acid**, and chloride-rich environments.

904L is an austenitic stainless steel with very low carbon content and high alloying, designed for environments with severe corrosion conditions. It has better corrosion resistance than 316L and 317L, while balancing price and performance, featuring high cost-effectiveness.

- **Grade and Standards:** UNS N08904, DIN1.4539, ASTM A240 (the new standard classifies it into the stainless steel series; the original standard ASME SB - 625 classified it into the nickel - based alloy series),
- **Typical Composition:** 20Cr - 24Ni - 4.3Mo - 1.5Cu.
- **Density:** 8.24.
- **Tensile Strength:**  $\sigma_b \geq 520\text{Mpa}$ .
- **Elongation:**  $\delta \geq 35\%$ .
- **Matching Welding Materials:** Welding electrodes (E385 - 16/17), welding wires (ER385).

## 904L Product available

### Standards Covering N08904 / 904L

<b>Product Form</b>	<b>ASTM/ASME Specification</b>
Plate/Sheet	ASTM B625 / ASME SB625
Bar/Rod	ASTM B649 / ASME SB649
Pipe/Tube	ASTM B677 / ASTM A312 / ASME SB677
Forgings	ASTM B564 / ASME SB564
Fittings	ASTM B366 / ASME SB366
Flanges	ASTM A182 F904L

### Chemical Composition of UNS N08904 (904L)

<b>Element</b>	<b>% (Typical Range)</b>
Nickel (Ni)	23.0 – 28.0
Chromium (Cr)	19.0 – 23.0
Molybdenum (Mo)	4.0 – 5.0
Copper (Cu)	1.0 – 2.0
Carbon (C)	≤ 0.020
Manganese (Mn)	≤ 2.0
Silicon (Si)	≤ 1.0

<b>Element</b>	<b>% (Typical Range)</b>
Phosphorus (P)	≤ 0.045
Sulfur (S)	≤ 0.035
Iron (Fe)	Balance

### **Mechanical Properties (Annealed Condition)**

<b>Property</b>	<b>Value</b>
Tensile Strength	≥ 490 MPa (71 ksi)
Yield Strength (0.2%)	≥ 220 MPa (32 ksi)
Elongation	≥ 35%
Hardness	≤ 90 HRB (approx. 220 HB)

## **Introduction to Corrosion Resistance**

Since the carbon content of 904L is very low (maximum 0.020%), no carbides will precipitate during general heat treatment and welding. This eliminates the risk of intergranular corrosion that occurs after general heat treatment and welding.

904L super stainless steel exhibits excellent corrosion resistance in various acids. Due to its high chromium, nickel, and molybdenum contents, and the addition of copper element, 904L can be passivated even in reducing environments, such as in sulfuric acid and formic acid. The high nickel content keeps its corrosion rate low even in the active state. In pure sulfuric acid with

a concentration range of 0 - 98%, the service temperature of 904L can reach up to 40 °C. In phosphoric acid with a concentration range of 0 - 85%, its corrosion resistance is very good. Among all kinds of phosphoric acids, the corrosion resistance of 904L is better than that of ordinary stainless steel. In strongly oxidizing nitric acid, the corrosion resistance of 904L is lower compared to high - alloy steel grades without molybdenum. In hydrochloric acid environments where various alloys are relatively vulnerable, the use of 904L is limited to a relatively low concentration of 1 - 2%. Within this concentration range, the corrosion resistance of 904L is better than that of conventional stainless steel.

904L super stainless steel also has very high pitting corrosion resistance, and its resistance to crevice corrosion in chloride solutions is also excellent. The high nickel content of 904L reduces the corrosion rate at pitting and crevices. Ordinary austenitic stainless steel may be sensitive to stress corrosion in a chloride - rich environment when the temperature is higher than 60 °C. By increasing the nickel content of stainless steel, this sensitivity can be reduced. Due to its high nickel content, 904L has very high resistance to stress corrosion cracking in chloride solutions, concentrated hydroxide solutions, and environments rich in hydrogen sulfide.