STAINLESS STEEL 304 GRADE SS 304

STAINLESS STEEL 304 / 304L Technical Data

Summary

Stainless steel **304** is the most versatile and the most widely used of all stainless steels. Its chemical composition, mechanical properties, weldability and corrosion/oxidation resistance provide the best all-round performance stainless steel at relatively low cost. It also has excellent low temperature properties and responds well to hardening by cold working. If intergranular corrosion in the heat affected zone may occur, it is suggested that SS 304L be used.

Typical Applications

SX 304 is used in all industrial, commercial and domestic fields because of its good corrosion and heat resisting properties. Some applications include:

Tanks and containers for a large variety of liquids and solids.
Process equipment in the mining, chemical, cryogenic, food, dairy and pharmaceutical industries.

Chemical Composition (ASTM A240)

SX	°C	Mn	P	S	Si	Cr	Ni
304 304L	0.08 max 0.03 max	2.0 max	0.045 max	0.030 max	1.0 max	18.0 to 20.0	8.0 to 10.50 8.0 - 12.0

Typical Properties in the Annealed Condition

The properties quoted in this publication are typical of mill production and unless indicated should not be regarded as guaranteed minimum values for specification purposes.

1. Mechanical Properties at Room Temperature

	304		304L	
	Typical	Minimum	Typical	Minimum
Tensile Strength, MPa	600	515	590	485
Proof Strength, (Offset 0.2 %), MPa	310	205	310	170
Elongation (Percent in 50mm)	60	40	60	40
Hardness (Brinell)	170	-	170	-
Endurance (fatigue) limit, MPa	240	-	240	-

2. Properties at elevated temperatures

All these values refer to **304 only**.

304L values are not given because its strength decreases markedly above 425°C.

Time Elevated Temperature Tensile Strength

Temperature, °C	600	700	800	900	1000
Tensile Strength, MPa	380	270	170	90	50

Creep data Stress for a creep rate of 1% in 10 000 h.

Temperature, °C	550	600	650	700	800
Stress, MPa	120	80	50	30	10

Maximum Recommended Service Temperature
(Oxidising Conditions)

Continuous Service 925°C
Intermittent Service 850°C

3. Properties at Sub-Zero Temperatures
(SX 304 / 304L)

Temperature	°C	-78	-161	-196
Tensile Strength	MPa	1100/950	1450/1200	1600/1350
Proof Stress (Offset 0.2%)	MPa	300/180	380/220	400/220
Impact Strength (Charpy V-Notch)	J	180/175	160/160	155/150

4. Corrosion Resistance

Aqueous
As a rough guide the following examples are given for certain pure acid-water mixtures-

Temperature °C	20						80					
Concentration, % by mass	10	20	40	60	80	100	10	20	40	60	80	100
Sulphuric Acid	2	2	2	2	1	0	2	2	2	2	2	2
Nitric Acid	0	0	0	0	2	0	0	0	0	0	1	2
Phosphoric Acid	0	0	0	0	0	2	0	0	0	0	1	2
Formic Acid	0	0	0	0	0	0	0	1	2	2	1	0

Key: 0 = resistant - corrosion rate less than 100 mm/year
1 = partly resistant - corrosion rate 100m to 1000 mm/year
2 = non resistant - corrosion rate more than 1000 mm/year

4.2 Atmospheric

The performance of SX 304 compared with other metals in various environments is shown in the following table. The corrosion rates are based on a 10 year exposure.

Environment	Corrosion Rate (mm/year)		
	SX 304	Aluminium-3S	Mild Steel
Rural	0.0025	0.025	5.8
Marine	0.0076	0.432	34.0
Marine Industrial	0.0076	0.686	46.2

Thermal Processing

1. **Annealing.** Heat from 1010ºC to 1120ºC and cool rapidly in air or water. The best corrosion resistance is obtained when the final annealing is above 1070ºC and cooling is rapid.

2. **Stress relieving.** SX 304L can be stress relieved at 450-600ºC for one hour with little danger of sensitisation. A lower stress relieving temperature of 400ºC maximum must be used.

3. **Hot working**

Initial forging and pressing:	1150 to 1260ºC
Finishing temperature:	900 to 925ºC

All hotworking operations should be followed by annealing.

Note: Soaking times to ensure uniformity of temperature are longer for stainless steels than for carbon steels - approximately 12 times.

Cold Working

SS 304 / 304L being extremely tough and ductile, are readily fabricated by old working. Typical operations include bending, forming, deep drawing and upsetting

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KEYWORDS:
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