MACSTEEL®

Data Sheet

STAINLESS STEEL | 316 / 316L TECHNICAL DATA

Description

316 is an improved version of 304 due to the addition of molybdenum and a slightly higher nickel content. The resultant composition of 316 gives the steel improved corrosion resistance in many aggressive environments. The molybdenum makes the steel more resistant to pitting and crevice corrosion in chloride-contaminated media, seawater and to acetic acid vapours. The lower rate of general corrosion in mildly corrosive environments gives the steel good atmospheric corrosion resistance in polluted marine atmospheres.

316 offers higher strength and better creep resistance at higher temperatures than 304. 316 also provides excellent mechanical and corrosion properties at sub-zero temperatures. When there is a danger of corrosion in the heat-affected zones of weldments, the lower-carbon variety 316L should be used.

Equivalents

316- S31600, EN 1.44401

316L- S31603, EN 1.4404

Typical application

316 has applications in many sectors of industry, some of these include:

- Chlorides containing and in polluted marine environments.
- Desalination plants, pipework, tanks, process vessels for more aggressive corrosive liquids.
- Specialised process equipment in the chemical, petro chemical, pulp and paper, pollutions control and petroleum industries.

Chemical composition (EN 10088-2 & ASTM A240)

Grade	%C	%Mn	%Si	%Cr	%Ni	%Mo
316L	0.03 max	2.0 max	0.75 max	10.5 - 18.0	10.5 - 184.0	2.0 - 3.0

Mechanical properties (EN 10088-2 & ASTM A240)

Grade	0.2% proof stress (MPa)	Tensile (MPa)	Elongation (%)	Hardness (HB)
316L	220 min	520 - 750	45 min	217 max

Short time elevated temperature tensile strength (MPa)

Grade	100°C	300°C	500°C	700°C	900°C
316L	530	510	420	250	90

Maximum recommended service temperature

Continuous service: 920°C

Intermitted service: 870°C

Corrosion resistance - Aqueous

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

Key 0 = resistant - corrosion rate less than 0.1µm/year
Key 1 = partly resistant - corrosion rate 0.1 - 1.0µm/year
Key 2 = non-resistant - corrosion rate more than 1.0µm/year

Corrosion resistance - Atmospheric

The performance of 316 compared with other metals in various environments is shown in the table below – the corrosion rates are based on 10-years exposure.

Environment	Corrosion Rate (µm/year)		
	316	Aluminium-3S	Mild Steel
Rural	0.0025	0.025	5.8
Marine	0.0076	0.432	34.0
Marine-industrial	0.0051	0.686	46.2

Thermal processing

Annealing

Heat to a range between 1010°C to 1120°C and cool rapidly in the air or water. The best corrosion resistance is obtained when the final annealing is above 1070°C.

Stress relieving

Heat from 200°C to 400°C and air cool.

Hot-working

Initial forging and pressing: 1150°C to 1200°C

Finishing temperature: Above 900°C

Note: All hot working operations should be followed by annealing.

Cold working

316 / 316L being extremely tough and ductile, is readily fabricated by cold working. Typical operations include bending, forming and deep drawing.

Note: Austenitic stainless steels work harden. Severe cold forming operations should be followed by annealing.

Welding

316L has good welding characteristics and is suited to all standard welding methods. Either matching (316L) or slightly over-alloyed filler wires such as 308L should be used. Weld discolouration should be removed by pickling and passivation to restore maximum corrosion resistance.