

Sales Offices	Phone	Fax
Adelaide	08 8345 1033	08 8345 1044
Brisbane	07 3722 0800	07 3277 6799
Melbourne	03 9409 8500	03 9408 3946
Sydney	02 9827 0790	02 9757 4486
Perth	08 9258 2600	08 9358 6206

PRODUCT DATA SHEET

Grades 310, 310S UNS S31000, S31008

Stainless Steel

Grade 310 is a medium carbon austenitic stainless steel, for high temperature applications such as furnace parts and heat treatment equipment. It is used at temperatures up to 1150°C in continuous service, and 1035°C in intermittent service. Grade 310S is a low carbon version of grade 310.

Chemical Composition, % (AS1449 / ASTM A240 – Flat Products)

	Carbon	Manganese	Silicon	Phosphorus	Sulphur	Chromium	Nickel
310	0.25 max	2.00 max	1.50 max	0.045 max	0.030 max	24.00 - 26.00	19.00 - 22.00
310S	0.08 max	2.00 max	1.50 max	0.045 max	0.030 max	24.00 - 26.00	19.00 - 22.00

Mechanical Properties (AS1449 / ASTM A240 – Flat Products)

Grade	0.2% Proof Stress MPa (min)	Tensile Strength MPa (min)	Elongation % (min)	Hardness HV (max)
310 / 310S	205	520	40	225

Typical Applications Grade 310/310S is used in fluidised bed combustors, kilns, radiant tubes, tube hangers for petroleum refining and steam boilers, coal gasifier internal components, lead pots, thermowells, refractory anchor bolts, burners and combustion chambers, retorts, muffles, annealing covers, saggars, food processing equipment, cryogenic structures.

Description These grades contain 25% chromium and 20% nickel, making them highly resistant to oxidation and corrosion. Grade 310S is a lower carbon version, less prone to embrittlement and sensitisation in service.

The high chromium and medium nickel content make these steels capable for applications in reducing sulphur atmospheres containing H₂S. They are widely used in moderately carburising atmospheres, as encountered in petrochemical environments. For more severe carburising atmospheres other heat resisting alloys should be selected. Grade 310 is not recommended for frequent liquid quenching as it suffers from thermal shock. The grade is often used in cryogenic applications, due to its toughness and low magnetic permeability.

In common with other austenitic stainless steels, these grades cannot be hardened by heat treatment. They can be hardened by cold work, but this is rarely practiced.

Austral Wright Metals can supply these grades as plate, sheet and strip, bar and rod, seamless tube and pipe, welded tube and pipe, forgings and forging billet, tube and pipe fittings, wire.

Corrosion Resistance Grade 310/310S is generally not used for corrosive liquid service, although the high chromium and nickel content give corrosion resistance superior to grade 304. The alloy does not contain molybdenum, so pitting resistance is quite poor. Grade 310/310S will be sensitised to intergranular corrosion after service at temperatures in range 550 - 800°C. Chloride stress corrosion cracking may take place in corrosive liquids containing chlorides at temperatures exceeding 100°C.

Heat Resistance Grades 310/310S have good resistance to oxidation in intermittent service in air up to 1035°C and 1050°C in continuous service. The grades are resistant to oxidation, sulphidation and carburisation.

Physical Properties (Typical, annealed)

Property	at	Value	Unit	Property	At	Value	Unit
Density		8,000	Kg/m ³	Melting Range		1400-1450	°C
Electrical Conductivity	25°C	1.25	% IACS	Specific Heat		500	J/kg. °C
Electrical Resistivity	25°C	0.78	Micro ohm . m	Relative Magnetic Permeability		1.02	
Modulus of Elasticity	20°C	200	GPa	Coefficient of Expansion	0 – 100°C	15.9	/ °C
Shear Modulus	20°C	77	GPa		0 – 315°C	16.2	/ °C
Poisson's Ratio	20°C	0.30			0 – 540°C	17.0	/ °C
				Thermal Conductivity	100°C	14.2	W / m . °C

Pressure Vessels AS1210, Pressure Vessels, allows the use of grade 310 up to 800°C.

Fabrication Grades 310/310S are forged in the temperature range 975 - 1175°C. Heavy work is carried out down to 1050°C and a light finish is applied to the bottom of the range. After forging annealing is recommended to relieve all stresses from the forging process. The alloys can be readily cold formed by standard methods and equipment.

Machinability Grades 310/310S are similar in machinability to type 304. Work hardening can be a problem and it is normal to remove the work hardened layer by using slow speeds and heavy cuts, with sharp tools and good lubrication. Powerful machines and heavy, rigid tools are used.

Welding Grades 310/310S are welded with matching electrodes and filler metals. The alloys are readily welded by SMAW (manual), GMAW (MIG), GTAW (TIG) and SAW. Electrodes to AWS A5.4 E310-XX and A 5.22 E310T-X, and filler metal AWS A5.9 ER310 are used. Argon is shielding gas.

Preheat and post heat are not required, but for corrosion service in liquids full post weld solution annealing treatment is essential.

Pickling and passivation of the surface to remove high temperature oxides are essential to restore full aqueous corrosion resistance after welding. This treatment is not required for high temperature service, but welding slag should be thoroughly removed.

Heat Treatment Type 310/310S are solution annealed by heating to temperature range 1040 - 1065°C, holding at temperature until thoroughly soaked, then water quenching.

Effect of Exposure at 480 - 650 °C on Room Temperature Toughness and Hardness

Temperature °C	Exposure Time			
	1,000 hours		10,000 hours	
	Charpy Impact J	Hardness HB	Charpy Impact J	Hardness HB
Unexposed	102	124	102	124
480		119	84	152
565	65	119	39	174
650	39	130	3	269

Mechanical Properties at Cryogenic Temperatures

Temperature °C	Yield Strength MPa	Tensile Strength MPa	Elongation %	Izod Impact J
-40	269	655	57	149
-62	276	689	55	149
-196	510	1048	54	115
-252	745	1213	56	