



E STEEL SDN BHD (891338-A)

NO 3, Lorong Sungai Puloh 7/KU 6,
Kawasan Perindustrian Sungai Puloh, 42100 Selangor D.E
Tel : 03-3292 8686 / 32928666 / 32928777
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Duplex Stainless Steel 2205, S31803, S32205, SUS329J3L, 1.4462, F51

Duplex 2205 is the most widely used duplex (ferritic/austenitic) stainless steel grade. It finds applications due to both excellent corrosion resistance and high strength. The standard duplex S31803 stainless steel composition has over the years been refined by many steel suppliers, and the resulting restricted composition range was endorsed as UNS S32205 in 1996. Duplex S32205 gives better guaranteed corrosion resistance, but for much of the Duplex S31803 currently produced also complies with Duplex S32205. Stainless steel 2205 is not generally suitable for use at temperatures above 300°C as it suffers from precipitation of brittle micro constituents, nor below -50°C because of its ductile-to-brittle-transition..It is used extensively by the Marine, Chemical, Petrochemical, Pulp and Paper, Oil and Gas, Transport and allied processing industries. Typical uses are: Anchor Guides, Conveyors, Fasteners, Bushings, High Strength Pump Shafts, Propellor Shafts, plus various applications currently using standard austenitic stainless steel grades.

Related Specifications

German	W.Nr 1.4462, DIN X2CrNiMoN22 5 3
USA	ASTM A276-98b, UNS S31803 , S32205

Chemical Composition	Min. %	Max. %
Carbon	0	0.03
Silicon	0	1.00
Manganese	0	2.00
Nickel	4.50	6.50
Chromium	21.00	23.00
Molybdenum	2.50	3.50
Nitrogen	0.08	0.20
Phosphorous	0	0.03
Sulphur	0	0.02

Mechanical Property Requirements - Annealed (As Supplied) to ASTM A276-98b UNS S31803 for Hot and Cold Finished

Tensile Strength Mpa (Min)	0.2 % Yield Strength Mpa (Min)	Elongation in 50mm % Min	Hardness HB Max
620	448	25	290

Typical Mechanical Properties at room temperature - Annealed

Tensile Strength (Mpa)	Yield Strength (Mpa)	Elongation in 50mm (%)	Charpy V Impact (J)	Hardness	
				HB	Rc
650 - 900	570	30	130	235	23

Elevated Temperature Properties*

While the oxidation resistance of 2205 is good at high temperature as with other duplex stainless steel grades, it is subject to embrittlement when exposed to temperatures above 300 °C even for short periods. It is subject to embrittlement at 475 °C when exposed for 2 hours only, also between 370 °C and 540 °C over a longer period.



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Precipitation of sigma phase will also occur above 650 °C resulting in decreased ductility and corrosion resistance. Duplex 2205 is therefore not recommended for use at temperatures above 300 °C.

Typical Mechanical Properties at Elevated Temperatures for 63.5 mm Dia Section - Annealed Condition

Test Temperature °C	Tensile Strength Mpa	Yield Strength Mpa	Charpy V Notch Impact After 100 Hours at Temp. J
315	650	390	45
370	640	375	22
480			5

N.B. Should embrittlement occur then annealing is required to rectify.

Low Temperature Properties

Duplex 2205 stainless steel is not recommended for use at temperatures below -50 °C, again due to its embrittling effect resulting in low ductility.

N.B. Unlike high temperature exposure however, the embrittling effect of low temperature exposure is not permanent, existing only for the duration at low temperature.

Typical Charpy V-Notch Impact Properties at Low and Sub Zero Temperatures

Test Temperature °C	Impact Test Charpy V-Notch
25	160
0	60
-20	30
-45	15

Corrosion Resistance

General Corrosion

S31803 has superior resistance to general corrosion in most media than ss316L or ss317L austenitic stainless steel grades

Stress Corrosion Cracking

S32205 has a much higher resistance to stress corrosion cracking than ss304L or ss316L austenitic stainless steel grades.

Pitting Corrosion

Duplex 2205 has a higher resistance to pitting corrosion than sus316L or sus317L austenitic stainless steel grades.

Crevice Corrosion / Erosion Corrosion

Duplex 2205 has a higher resistance to crevice corrosion and erosion corrosion than sus316L austenitic stainless steel grade.

Corrosion Fatigue



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Duplex stainless steel 2205 has better fatigue strength in corrosive environments than the standard austenitic stainless steel grades due to its higher strength and higher corrosion resistance.

Heat Treatment

Annealing

Heat to 1020 °C - 1100 °C. Hold until temperature is uniform throughout the section. *Soak as required.

Quench in water to obtain optimum corrosion resistance.

*Actual soaking time should be long enough to ensure that the part is heated thoroughly throughout its section to the required temperature, 30 minutes per 25mm of section may be used as a guide.

Machining

The machinability of S31803 in the annealed as supplied condition is lower than either SUS 304 and SUS 316 due to its higher yield strength (approximately double).

Typically 80% as machinable as the standard SUS304 and SUS316 grades, but lower against the improved machinability SS304 and SS316 stainless steel.

N.B. All machining should be carried out as per machine manufacturers recommendations for suitable tool type, feeds and speeds.

Welding

Duplex 2205 is readily weldable by the various standard electric arc welding processes.

Oxycacetylene welding is however not recommended due to the possibility of carbon pick up in the weld area.