VULCAN
Engineering Steels

303 STAINLESS STEEL

303 is a free machining austenitic stainless steel with good strength and corrosion resistance. 303 is characterized by excellent machinability and non-galling properties. The Sulphur addition does slightly lower it's corrosion resistance when compared to 304 S/S, and has low resistance to acids.
303 cannot be hardened by thermal treatment, but strength and hardness can be improved by cold drawing with subsequent reduction in ductility.

Stocked Sizes	-	Rounds	6 mm – 150 mm Ø
Bar Finishes	-	Peeled, Turned & Polished, Cold Drawn & Centreless Ground	

Related Specifications		
Germany	W Nr 1.4305 X10CrNiS 18 9	
Japan	JIS G4303 SUS 303	
United Kingdom	BS970 Part 3 1991 303S31 BS970 1955 EN58M	
USA	ASTM A582/582M-95b 303 SAE 30303 AISI 303 UNS S30300	
Chemical Composition*		
	Min. %	**Max %**
Carbon	0	0.15
Silicon	0	1.00
Manganese	0	2.00
Nickel	8.00	10.00
Chromium	17.00	19.00
Phosphorous	0	0.06
Sulphur	0.15	0.35
***Molybdenum content up to 1.00% is optional**		
Mechanical Property Requirements to ASTM A582/582M-95b 303 is annealed to Max 262 Bhn		
Typical Mechanical Properties (For Ref Only)	**Cold Drawn**	**Other**
Tensile Strength Mpa	690	550
0.20% Proof Stress (Yield) Mpa	415	240
Elongation on %	36	55
Charpy Impact J		120
Hardness Brinell HB	220	165
Annealing		
Heat uniformly to 1150-1200 Deg C. Hold until temperature is uniform throughout section. Soak as required (as a guide 30 minutes per 25mm of section) Quench in water to optimize corrosion resistance.		

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304 STAINLESS STEEL

304 is a chromium-nickel austenitic stainless steel with good strength and very good corrosion resistance. 304 has very good corrosion resistance to most oxidizing agents. 304 cannot be hardened by thermal treatment, but strength and hardness can be improved by cold drawing with subsequent reduction in ductility. This is a non-magnetic grade, however it can become mildly magnetic following cold working. Annealing is required to rectify if necessary.

Stocked Sizes	-	Rounds	4.76 mm – 203.2 mm Ø
Bar Finishes	-	Peeled, Turned & Polished, Cold Drawn & Centreless Ground	

Related Specifications		
Germany	W. Nr 1.4301 X5CrNi 18 10	
Japan	JIS G4303 SUS 304	
United Kingdom	BS 970 Pt 3 1991 304S15/304S31	
USA	ASTM A276-98b 304 SAE 30304 AISI 304 UNS30400	
Chemical Composition*		
	Min. %	**Max %**
Carbon	0	0.08
Silicon	0	1.00
Manganese	0	2.00
Nickel	8.00	10.50
Chromium	18.00	20.00
Phosphorous	0	0.045
Sulphur	0	0.03
***Molybdenum content up to 1.00% is optional**		

Typical Mechanical Properties (For Ref Only)	**Cold Drawn**	**Other**
Tensile Strength Mpa	680	590
0.20% Proof Stress (Yield) Mpa	500	240
Elongation on %	42	55
Hardness Brinell HB	195	155

Annealing

Heat uniformly to 1020-1100 Deg C. Hold until temperature is uniform throughout section. Soak as required (as a guide 30 minutes per 25mm of section) Quench in water to optimize corrosion resistance.

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316/316L STAINLESS STEEL

316 is a chromium-nickel-molybdenum austenitic stainless steel with good strength and excellent corrosion resistance. Supplied in the annealed condition and with the addition of molybdenum, 316 stainless steel is ideally suited for marine applications, as well as showing excellent resistance to a variety of chemicals. 316L has a reduced carbon content which increases weldability and reduces the need for post weld annealing. Both 316 and 316L cannot be hardened further by thermal heat treatment, but strength and hardness can be significantly improved by cold working, with subsequent reduction in ductility. 316/316L is non magnetic, but can become mildly magnetic after heavy cold working. Annealing is required to rectify this problem, as well as optimizing corrosion resistance.

Stocked Sizes	-	Rounds	4.76 mm – 450 mm Ø
	-	Hexagon	7.94mm – 63.5mm A/F
	-	Square	6.35mm – 50mm A/F
Bar Finishes	-	Peeled, Turned & Polished, Cold Drawn & Centreless Ground	

Related Specifications	**316 S/S**	**316L S/S**
Germany	W. Nr 1.4401 X5CrNiMo17 12 2	W. Nr 1.4404 X2CrNiMo17 12 2
Japan	JIS G4303 SUS 316	JIS G4303 SuS 316L
United Kingdom	BS 970 Pt 3 1991 316S31/316S33 BS 970 1955 EN58J	BS 970 Pt 3 1991 316S11/316S13
USA	ASTM A276-98b 316 SAE 30316 AISI 316 UNS31600	ASTM A276-98b 316L SAE 30316L AISI 316L UNS31603
Chemical Composition*		
	316 S/S	**316L S/S**
Carbon	0.07% Max	0.03% Max
Silicon	1.00% Max	1.00% Max
Manganese	2.00% Max	2.00% Max
Nickel	10.00 – 14.00%	10.00 – 14.00%
Chromium	16.00 – 18.00%	16.00 – 18.00%
Molybdenum	2.00 – 3.00%	2.00 – 3.00%
Phosphorous	0.045% Max	0.045% Max
Sulphur	0.030% Max	0.030% Max

Annealed Typical Mechanical Properties (For Ref Only)	**Cold Drawn**	**Other**
Tensile Strength Mpa	680	590
0.20% Proof Stress (Yield) Mpa	500	280
Elongation on %	42	55
Hardness Brinell HB	195	155

Annealing

Heat uniformly to 1020-1100 Deg C. Hold until temperature is uniform throughout section. Soak as required (as a guide 30 minutes per 25mm of section) Quench in water to optimize corrosion resistance. Please consult your heat treater for best results

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431 MARTENSITIC STAINLESS STEEL

431 is a high chromium- low nickel high hardenability martensitic stainless steel which exhibits high strength and good corrosion resistance. It is generally supplied hardened and tempered to 850-1000 Mpa UTS (Condition T). 431 is capable of being through hardened up to 44 HRC, as well as the ability to be nitride with surface hardness up to 65 HRC. Note that nitriding does reduce the corrosion resistance of this grade and should be considered carefully when choosing this process.
Typical uses include pump shafts, propeller shafts, studs, valve parts, fasteners etc.

Stocked Sizes	-	Rounds	6.35 mm – 230 mm Ø
Bar Finishes	-	Peeled, Turned & Polished, Cold Drawn & Centreless Ground	

Related Specifications		
Germany	W. Nr 1.4057 X20CrNi17 2	
Japan	JIS G4303 SUS 431	
United Kingdom	BS 970 Pt 3 1991 431S29	
USA	ASTM A276-98b 431 SAE 51431 AISI 431 UNS43100	
Chemical Composition		
	Min. %	**Max %**
Carbon	0.12	0.20
Silicon	0	1.00
Manganese	0	1.00
Nickel	1.25	2.50
Chromium	15.00	17.00
Phosphorous	0	0.04
Sulphur	0	0.03

Typical Mechanical Properties	**Annealed**	**Q&T Cond T**
Tensile Strength Mpa		850-1000
0.20% Proof Stress (Yield) Mpa		635 Min
Elongation on %		11
Hardness Brinell HB	277 Max	248-302

Annealing

Full annealing of this grade is not possible, as 431 hardens even during a slow cooling cycle. It is recommended that you consult with a heat treatment company should you wish to anneal this material. Process annealing is performed at 620-660 deg C and then air cooled.