

Technical Data

CS441



**COLUMBUS
STAINLESS**
— [Pty] Ltd —

Technical Data

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INTRODUCTION

CS441 is a low carbon, dual stabilised ferritic stainless steel. With 18% chromium, the steel has good corrosion resistance in mildly corrosive environments and good oxidation resistance at elevated temperatures. Annealed CS441 is ductile and can be formed using a wide range of roll forming or mild stretch bending operations as well as the more common drawing and bending operations. CS441 does not harden excessively during cold working.

The steel has limited weldability and should not be used in the as-welded condition for dynamic or impact loaded structures. As with most ferritic stainless steels, CS441 can undergo grain growth in the heat affected zone of weldments, which may adversely affect the mechanical properties in these zones. Applications involving welded CS441 are thus generally limited to a maximum thickness of 2.5mm.

Being a ferritic stainless steel, CS441 is unsuited for use in cryogenic applications as brittle fracture could occur at sub-zero temperatures.

CS441 has good high temperature oxidation resistance and creep resistance and this makes it suitable for use in applications in the tube and automotive industries.

PRODUCT RANGE

The latest revision of the Product Guide should be consulted, as the product range is subject to change without notice. The Product Guide is available from the Technical Customer Services Department or can be found at www.columbusstainless.co.za

SPECIFICATIONS & TOLERANCES

Columbus Stainless (Pty) Ltd supplies CS441 to ASTM A240 (S43940) and EN 10088-2 (1.4509).

Columbus Stainless (Pty) Ltd normally supplies material to the following tolerances:

COLD ROLLED

ASTM A480M

ASME SA480M

EN ISO 9445

Other tolerances may be available on request. Further information is available in the Product Guide, which can be obtained from the Technical Customer Services Department or can be found at www.columbusstainless.co.za

CHEMICAL COMPOSITION

In accordance with ASTM A240 (S43940) and EN 10088-2 (1.4509).

Type	%C	%Si	%Mn	%P	%S	%Cr	%N	%Nb	%Ti
S43940	0.030 max	1.00 max	1.00 max	0.040 max	0.015 max	17.50 18.50		0.3+ (3xC) min	0.10 0.60
1.4509	0.030 max	1.00 max	1.00 max	0.040 max	0.015 max	17.50 18.50	0.045 max	0.3+ (3xC) 1.00	0.10 0.60

MECHANICAL PROPERTIES

In accordance with ASTM A240 (S43940) and EN 10088-2 (1.4509).

Type	Product Form ¹	0.2% Proof Stress (MPa)	Tensile Strength (MPa)	Elongation (%)	Brinell Hardness
S43940	C	250 min	430 min	18 min ²	180 max
1.4509	C	250 min	430 630	18 min ²	

1) C = cold rolled strip.

2) Elongation over a gauge length of 50mm.

PROPERTIES AT ELEVATED TEMPERATURES

The properties quoted below are typical of annealed CS441. These values are given as a guideline only, and should not be used for design purposes.

SHORT TIME ELEVATED TEMPERATURE TENSILE STRENGTH

Temperature (°C)	100	300	500	700
Tensile Strength (MPa)	460	400	350	200

MAXIMUM RECOMMENDED SERVICE TEMPERATURE (In oxidising conditions)

Operating Conditions	Temperature (°C)
Continuous	850
Intermittent	950

REPRESENTATIVE CREEP RUPTURE PROPERTIES

Temperature (°C)	Stress to Produce Rupture (MPa) 10 000 Hours
480	179
540	90
600	45
700	25

PHYSICAL PROPERTIES

The values given below are for 20°C, unless otherwise specified.

Density	7 800kg/m ³
Modulus of Elasticity in Tension	200GPa
Modulus of Elasticity in Torsion	65GPa
Specific Heat Capacity	460J/kgK
Thermal Conductivity: @ 100°C	26.1W/mK
@ 500°C	26.3W/mK
Electrical Resistivity	600η m
Mean Co-efficient of Thermal Expansion: 0 – 100°C	10.4μm/mK
0 – 315°C	11.0μm/mK
0 – 540°C	11.4μm/mK
0 – 700°C	12.1μm/mK
Melting Range	1 425–1 510°C
Relative Permeability	Ferromagnetic

THERMAL PROCESSING & FABRICATION

ANNEALING

Annealing is achieved by heating to between 760°C and 830°C for 90 minutes per 25mm followed by air quenching.

STRESS RELIEVING

Stress relieving after welding is not normally required. Should this be necessary, temperatures between 200°C and 300°C are recommended.

HOT WORKING

Uniform heating of the steel in the range of 950°C to 1 050°C is required. The finishing temperature should be below 750°C. Extended holding times above 1 000°C should be avoided as excessive grain growth may occur and ductility may be detrimentally affected. All hot working operations should be followed by annealing and pickling and passivating to restore the mechanical properties and corrosion resistance.

COLD WORKING

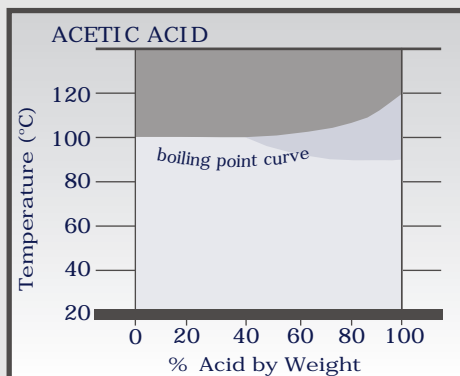
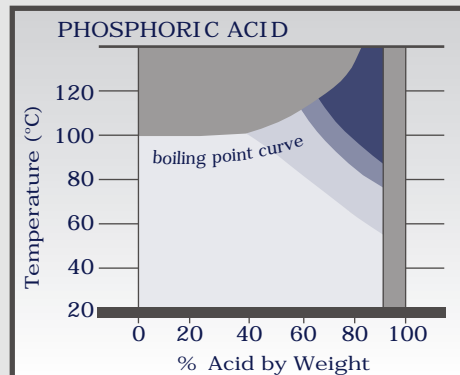
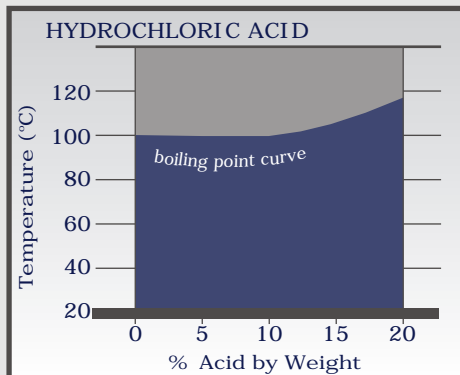
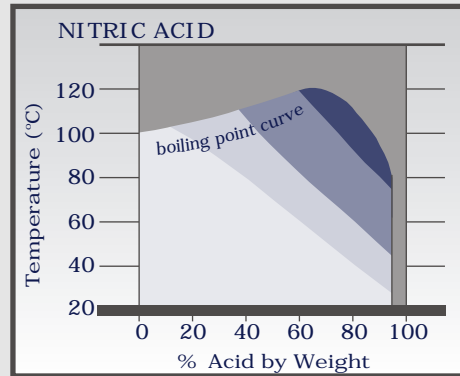
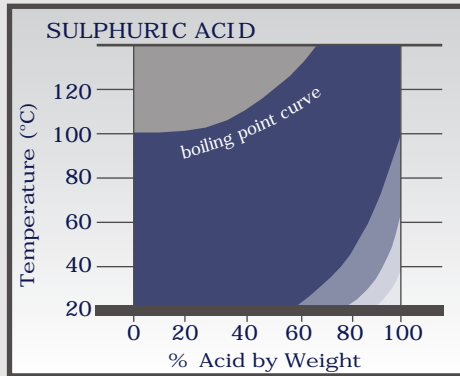
CS441 has good formability characteristics with useful mechanical properties. Its good ductility allows it to be readily formed by bending and deep drawing. CS441 does not undergo significant work hardening when cold formed.

WELDING

Being ferritic, CS441 is prone to grain growth in the heat affected zone of weldments. As such, the tensile, fatigue and toughness properties in the welded condition are relatively poor. CS441 should thus not be used for applications where tensile or dynamic loading will be experienced. CS441 is generally limited to a combined thickness of 2.5 mm in the welded condition, i.e. for lap joints, this is equivalent to 2 x 1.25mm thickness being welded together. The use of austenitic filler metals such as types 308L, 309L or 316L will improve the ductility of welds to some extent but all welding procedures should nevertheless endeavour to maintain minimum heat inputs. The weld discolouration should be removed by pickling and passivating to restore maximum corrosion resistance.

CORROSION RESISTANCE

CS441 has good resistance to a wide variety of corrosive environments. It is generally used in the automotive industry for exhaust systems. Atmospheric corrosion resistance is good, although in highly polluted or marine environments staining may occur.



KEY

	mils per year	mm per year
	< 1	< .03
	1-5	.03-.13
	5-30	.13-.75
	> 30	> .75

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