

1.4034

X46Cr13

Chromium martensitic stainless steel

C 0.43 – 0.50 Cr 12.50 – 14.50 S ≤ 0.03

General comments

1.4034 is characterised by its high hardenability in conjunction with good corrosion resistance in moderately corrosive environments. Due to its higher carbon content, it is more hardenable than 1.4031. It is used in the quenched and tempered condition and due to its high hardness, is ideally suited for the production of cutting tools and the production of roller bearings.

Relevant current and obsolete standards

EN 10088-3	1.4034	X46Cr13
AISI	420	
BS	420S45	
AFNOR	Z44C14 / Z38C13	
DIN 17440	1.4034	

Special grades for particular applications

drawing grade

General properties

corrosion resistance	average
mechanical properties	excellent
forgeability	good
weldability	poor
machinability	poor

Special properties

ferromagnetic grade
hardenable to 55 HRC

Physical properties

density (kg/dm ³)	7.70
electrical resistivity at 20 °C (Ω mm ² /m)	0.55
magnetizability	yes
thermal conductivity at 20 °C (W/m K)	30
specific heat capacity at 20 °C (J/kg K)	460
thermal expansion (K ⁻¹)	20 – 100 °C: 10.5 × 10 ⁻⁶ 20 – 200 °C: 11.0 × 10 ⁻⁶ 20 – 300 °C: 11.5 × 10 ⁻⁶ 20 – 400 °C: 12.0 × 10 ⁻⁶

Typical applications

medical and pharmaceutical industry
roller bearings
mechanical engineering
cutlery, blade and tool industry

Note: available from stock

Processing properties

automated machining	seldom
machinable	yes
hammer and die forging	seldom
cold forming	seldom
cold heading	not common
suited to polishing	yes

Conditions

annealed, tempered

Demand tendency

rising

Corrosion resistance (PRE = 12.5 – 14.5)

Good corrosion resistance in moderately corrosive environments that are free of chlorides, such as soaps, detergents and organic acids. Good resistance to water and steam. 1.4034 is not resistant to intergranular corrosion in the as-delivered or as-welded conditions. Due to the precipitation of chromium carbides and the formation of chromium depleted regions adjacent to these precipitates, 1.4034 should not be used in the soft annealed or over tempered conditions if corrosion resistance is an issue. Optimal corrosion resistance is thus achieved in the hardened condition with a polished surface finish.



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Heat treatment and mechanical properties

1.4034 can be soft annealed by holding at a temperature in the range 750 °C to 850 °C followed by slow cooling in an oven or in air. In this condition, the following mechanical properties can be expected:

Property		Specification
tensile strength (N/mm ²)	R _m	≤ 800
hardness	HB	≤ 245

Note: the HB values could be 60 units higher and the tensile strengths 150 N/mm² higher due to cold work during straightening of profiles ≤ 35 mm.

This steel may be hardened by heating to 1050 °C followed by rapid cooling in air or oil. After hardening and stress relieving at 200 °C, the hardness should not exceed 55 HRC (570 HB).

The mechanical properties (d ≥ 160 mm) have to be agreed on for thicker dimensions, or the delivered product is based on the values given.

Welding

Although 1.4034 is generally not welded, it is soldered in some instances.

Forging

Gradual heating to a temperature of about 800 °C is recommended prior to more rapid heating to a temperature of between 1150 °C and 1180 °C. Forging then takes place between 1180 °C – 950 °C followed by slow cooling in an oven or in dry ash or similar material to promote slow cooling.

Machining

The machinability of this grade of stainless steel is directly related to its hardness. 1.4034 machines similar to carbon steels of the same hardness. Although it must be realised that the machining parameters will vary depending on the structure/hardness of the steel, the following parameters can be used as a guideline when machining with coated hardmetal tools:

	Depth of cut (mm)	6	3	1
	Feed rate (mm/r)	0.5	0.4	0.2
Annealed R_m 700 – 800 N/mm²	Cutting speed (m/min)	115	140	160