1.4310

X10CrNi18-8

Chromium-nickel austenitic stainless steel

C 0.05 – 0.15 **Cr** 16.00 – 19.00 **Ni** 6.00 – 9.50 **Mo** max. 0.80 **N** max. 0.11

General comments

1.4310 is essentially a leaner version of 1.4301, which as a result of its combination of high chromium and restricted nickel content, produces a metastable austenitic structure which will work harden / strengthen very rapidly when subjected to cold deformation. Since this steel is used for the production of spring components, the final microstructure will contain a significant amount of shear induced martensite and as such will be relatively magnetic.

Relevant current and obsolete standards

EN 10088-3	1.4310	X10CrNi18-8
AISI	301	
BS	301S21	
AFNOR	Z12CN17-07 / Z12CN18-07	
DIN 17440	1.4310	

General properties

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

Special properties

can be used as a spring steel to 300 °C

Physical properties

density (kg/dm³)	7.90
electrical resistivity at 20 °C (Ω mm²/m)	0.73
magnetizability	slight
thermal conductivity at 20 °C (W/m K)	15
specific heat capacity at 20 °C (J/kg K)	500
thermal expansion (K^{-1})	20 – 100 °C: 16.0 x 10^{-6}
	20 – 200 °C: 17.0 x 10^{-6}
	20 – 300 °C: 17.0 x 10^{-6}
	20 – 400 °C: 18.0 x 10^{-6}
	20 – 500 °C: 18.0 x 10^{-6}

Typical applications

automotive industry
various corrosion resisting spring components
chemical industry
food and beverage industry
electronic equipment

Processing properties

automated machining	seldom
machinable	yes
hammer and die forging	yes
cold forming	yes
cold heading	yes
suited to polishing	yes

Conditions

solution annealed and quenched

Demand tendency

constant

Corrosion resistance (PRE = 16.0 – 23.4)

Due to the moderate carbon content of 1.4310, this grade of stainless steel is prone to sensitisation. The formation of chromium carbides and the associated chromium depleted regions that form around these precipitates make this grade of steel susceptible to intergranular corrosion. Although the EN 10088-3: 1995 Norm indicates that this steel is not resistant to intergranular corrosion in 1.4310 is resistant to this form of corrosion in the assupplied condition.
1.4310 finds extensive use as a spring material in the food and beverage industry where the combination of good mechanical properties and corrosion resistance is essential. The corrosion resistance in most common food and beverage environments is good, but as a result of its lower nickel content, 1.4310 is not as resistant to corrosion as 1.4301. It must also be borne in mind that the corrosion resistance of 1.4310 diminishes with increasing cold deformation, i.e. the higher the strength / hardness of this material, the lower the corrosion resistance.
Surface condition plays an important role in the corrosion resistance of this steel with polished surfaces exhibiting far superior corrosion resistance compared with rougher surfaces on the same material.

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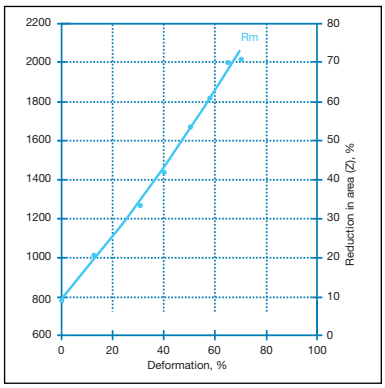
Heat treatment and mechanical properties

Optimal material properties are realised after solution annealing in the temperature range 1000 °C – 1100 °C followed by rapid cooling in air or water. Since this grade of steel is susceptible to precipitation of chromium carbides, care must be taken to limit the time spent in the temperature range 450 °C to 850 °C, both during fabrication and service. In the solution annealed condition, the following mechanical properties may be attained when testing in the longitudinal direction:

Property		Specification	Typical
yield strength (N/mm²)	$R_{p0.2}$	≥ 195	400
tensile strength (N/mm²)	R_m	500 – 750	710
tensile elongation (%)	A_5	≥ 40	45
hardness	HB	≤ 230	

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

Elevated temperature properties



A typical work hardening curve for 1.4310

Welding

Since 1.4310 is primarily used for the production of springs, there is generally no requirement for welding. Should welding be required, however, 1.4310 is weldable with or without the use of filler material. If the use of a filler metal is required, then the use of Novonit 4316 (AISI 308L) would be recommended. A maximum interpass temperature of 200 °C must be adhered to. Post weld heat treatment is not necessary. Please note that welding of cold worked components will result in the welded zone displaying significantly reduced mechanical properties compared with the rest of the weldment.

Forging

1.4310 is usually heated to within the range 1150 °C – 1180 °C to allow forging to take place at temperatures between 1200 °C and 900 °C. Forging is followed by air cooling, or water quenching when no danger of distortion exists.

Machining

The combination of low thermal conductivity and extremely high work hardening rate serves to make 1.4310 difficult to machine. The following cutting parameters are thus proposed as a guideline when machining NIRO-CUT® 4310 using adequate cooling and coated hard metal cutting tools.

	Depth of cut (mm)	6	3	1
	Feed rate (mm/r)	0.5	0.4	0.2
Solution annealed R_m 550 – 650 N/mm²	Cutting speed (m/min)	130	210	250

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