

1.4003

X2CrNi12

Stainless ferritic, chromium steel

C max. 0.03 Cr 10.50 – 12.50 Ni 0.30 – 1.00

General comments

1.4003 is a ferritic chromium steel which is suited for mildly corrosive applications, whilst the mechanical properties are comparable to those of unalloyed carbon steels. Unlike other ferritic stainless steels 1.4003 displays a higher strength and can be welded in thicker sections which makes it ideally suited for the construction industry. The prospects of this grade of steel in the building and constructional industries are exceptionally good since 1.4003 offers good mechanical properties, weldability and corrosion resistance at a reasonable cost.

Relevant current and obsolete standards

EN 10088-3	1.4003	X2CrNi12
DIN 17440	1.4003	
SEW 400	1.4003	

Special grade for particular use

cold heading grade

General properties

corrosion resistance	low
mechanical properties annealed	soft
mechanical properties tempered	good
forgeability	good
weldability	good
machinability	good

Special properties

ferromagnetic grade
magnetically soft, $H_C < 200$ A/m

Physical properties

density (kg/dm ³)	7.70
electrical resistivity at 20 °C (Ω mm ² /m)	0.60
magnetizability	yes
thermal conductivity at 20 °C (W/m K)	25
specific heat capacity at 20 °C (J/kg K)	460
thermal expansion (K ⁻¹)	20 – 100 °C: 10.4×10^{-6} 20 – 200 °C: 10.8×10^{-6} 20 – 300 °C: 11.2×10^{-6} 20 – 400 °C: 11.6×10^{-6} 20 – 500 °C: 11.9×10^{-6}

Typical applications

automotive industry
building industry
electronic equipment
mechanical engineering
sugar industry
mining industry
transport industry

Note: 1.4104 can be used as an alternative.
supplied in accordance with the Z-30.3-6 building regulation
dimensional limits can be agreed on

Processing properties

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

Conditions

annealed, tempered

Demand tendency

rising

Corrosion resistance (PRE = 10.5 – 12.5)

As a result of its nominal chromium content, 1.4003 displays moderate corrosion resistance to slightly aggressive, non chloride containing environments. 1.4003 is substantially more resistant to corrosion than the common constructional steels and is often selected in preference to these steels since no expensive corrosion protection or coating system is required and in the long run maintenance costs will be lower. 1.4003 is also resistant to wet abrasion. When used for decorative applications or when the environment is more corrosive, then the use of a protective coating is recommended.



1.4003

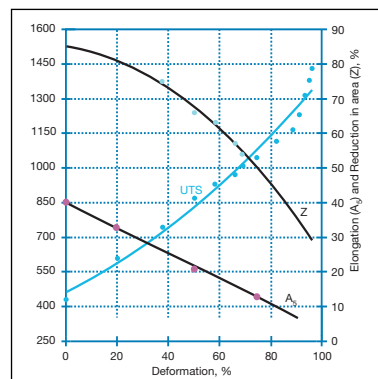
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Heat treatment and mechanical properties

The chemical composition of this steel allows it to be hardened by heat treatment and as such a range of mechanical properties may be attained. 1.4003 may be annealed by holding in the temperature range 680 °C to 740 °C followed by air cooling. In this condition the following mechanical properties can be expected:

Property	Specification	Typical
yield strength (N/mm ²)	R _{p0.2} ≥ 260	320
tensile strength (N/mm ²)	R _m 450 – 550	530
tensile elongation (%)	A ₅ ≥ 20	28
hardness	HB ≤ 200	180
impact energy (J) 25 °C	ISO-V ≥ 100	220



A typical work hardening curve for 1.4003

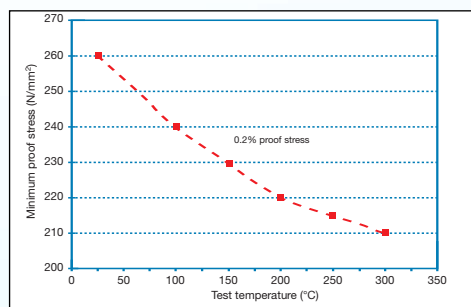
1.4003 can also be quenched and tempered and in this condition, the following mechanical properties can be expected:

Property	Specification	Typical
yield strength (N/mm ²)	R _{p0.2} ≥ 400	428
tensile strength (N/mm ²)	R _m 500 – 750	570
tensile elongation (%)	A ₅ ≥ 20	23
impact energy (J) 25 °C	ISO-V ≥ 100	200

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

Susceptibility to both 475 °C and sigma phase embrittlement limit the use of this material to temperatures below 350 °C.



Minimum tensile properties at various temperatures, shown in the diagram, are specified in the EN 10088-3.

Welding

1.4003 is readily weldable using all common welding processes, except gas welding. When the application of a filler metal is required, then Novonit® 4316, viz. 1.4370, can be used. Post weld heat treatment is generally not required, but any spatter or heat tint must be removed to restore the corrosion resistance to an acceptable level.

Forging

Forging generally takes place at temperatures between 1180 °C – 1000 °C followed by slow cooling.

Machining

As a result of its ferritic microstructure in the annealed condition, 1.4003 tends to smear when machined. This phenomenon can be counteracted to some extent by using coated hard metal cutting/machining tools combined with adapted cutting/machining parameters. The following machining parameters can be used as a guideline when machining 1.4003. A 10 % improvement in cutting speed can be achieved for the quenched and tempered condition (R_m 500 – 700 N/mm²).

	Depth of cut (mm)	6	3	1
	Feed rate (mm/r)	0.5	0.4	0.2
Annealed R_m 450 – 520 N/mm²	Cutting speed (m/min)	160	190	260