1.4462

X2CrNiMoN22-5-3

Stainless duplex austenitic-ferritic, chromium nickel molybdenum steel

C max. 0.03 **Cr** 21.00 – 23.00 **Ni** 4.50 – 6.50 **Mo** 2.50 – 3.50 **N** 0.12 – 0.22

General comments

1.4462 belongs to the family of dulpex stainless steels. This steel is characterised by its excellent combination of corrosion resistance, comparable to that of the austenitic grade 1.4404, and strength, about 150 % higher than that of the 1.4404 austenitic grades.
The use of duplex stainless steels, especially 1.4462 are gaining popularity due to their unique combination of excellent corrosion resistance, resistance to stress corrosion cracking and high tensile and yield strengths. As a result of its high strength, this steel is ideally suited to the constructional industry. The relatively lower nickel content, relative to the conventional austenitic grades, also makes 1.4462 an interesting alternative from an economic point of view.

Relevant current and obsolete standards

EN 10088-3	1.4462	X2CrNiMoN22-5-3
ASTM	A182F51	
BS	318S13	
JIS	329J3L	
AFNOR	Z3CND 22-05 Az	
DIN 17440	1.4462	
SIS	2377	
UNS	S31803	
VD-TÜV-Blatt 418	1.4462	
FALC 223	1.4462	

Special grades for particular applications

welding wire	Novonit® 4462

General properties

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

Special properties

can be used to temperatures of 350 °C
ferromagnetic grade
can also be used for cryogenic applications up to -100 °C

Physical properties

density (kg/dm³)	7.80
electrical resistivity at 20 °C (Ω mm²/m)	0.79
magnetizability	possible
thermal conductivity at 20 °C (W/m K)	14
specific heat capacity at 20 °C (J/kg K)	500
thermal expansion (K^{-1})	20 – 100 °C: 13.0 x 10^{-6}
	20 – 200 °C: 13.5 x 10^{-6}
	20 – 300 °C: 14.0 x 10^{-6}

Typical applications

construction industry
chemical industry
petro-chemical industry
electronic equipment
food and beverage industries
mechanical engineering
off-shore structures and ship building

Note: available from stock
supplied in accordance with the Z-30.
3-6 building regulation

Processing properties

automated machining	no
machinable	yes
hammer and die forging	yes
cold forming	yes
cold heading	in some distances
suited to polishing	yes

Conditions

solution annealed and quenched

Demand tendency

sharply rising

1.4462

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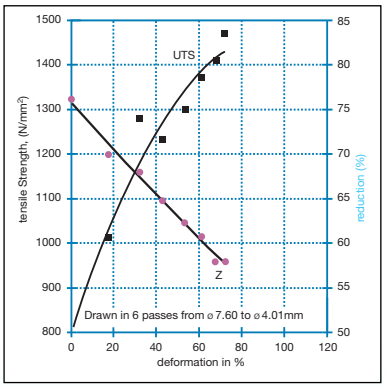
Corrosion resistance (PRE = 30.85 – 38.07)

Superb corrosion resistance in chloride containing and acid environments, especially in phosphoric and organic acids. Corrosion resistance is superior to that of 1.4404. As a result of the duplex structure 1.4462 exhibits superior corrosion resistance to the austenitic grades in that it is not susceptible to intergranular corrosion and also in that this grade of steel is exceptionally resistant to stress corrosion cracking. This stainless steel is also resistant to pitting corrosion, which together with its resistance to stress corrosion cracking accounts for its extensive use in off-shore applications.

Heat treatment and mechanical properties

Optimal corrosion and mechanical properties can be obtained by solution annealing the steel at temperatures between 1050 °C und 1100 °C followed by rapid cooling in air or water. In this condition, the following mechanical properties can be expected:

Property		Specification	Typical
yield strength (N/mm²)	$R_{p0.2}$	≥ 450	550
tensile strength (N/mm²)	R_m	650 – 880	850
tensile elongation (%)	A_5	≥ 25	30
hardness	HB	≤ 270	260
impact energy (J) 25 °C	ISO-V	≥ 100	270

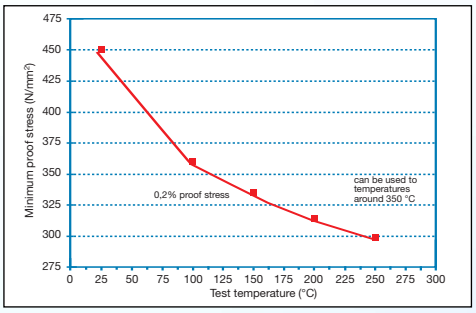


A typical work hardening curve for 1.4016

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



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

Welding

Like all duplex stainless steels, care must be taken when welding 1.4462. The optimal enveope of welding parameters is small and as such deviations outside these optimal limits could lead to poor welds. Within the prescribed welding parameters, weldability is good. The use of slightly higher heat inputs (1 – 3 kJ/mm), during welding is preferable since this results in a better phase distribution in the weld zone, which in turn results in improved mechanical properties of the weldment.

Forging

Care should be taken when forging since 1.4462 is susceptible to problems when subjected to shock loading at elevated temperatures. Gradual heating to a temperature of 1200 °C is recommended to allow forging to take place at temperatures between 1200 °C – 900 °C. Forging should be followed by air cooling.

Machining

Like all duplex stainless steels, 1.4462 is only machinable with some difficulty. The factors responsible for this are the high strength and duplex structure. The optimal cutting/machining parameters lie within a much narrower band than is the case with the austenitic grades. Coated hard metal cutting/machining tools or the use of Cermets are recommended for the machining of 1.4462. The following machining parameters can be used as a guideline.

	Depth of cut (mm)	6	3	1
	Feed rate (mm/r)	0.5	0.4	0.2
Solution annealed R_m 660 – 750 N/mm²	Cutting speed (m/min)	110	140	175

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