1.4418

X4CrNiMo16-5-1

Stainless soft martensitic chromium-nickel-molybdenum steel

C max. 0.06 **Cr** 15.00 – 17.00 **Ni** 4.00 – 6.00 **Mo** 0.80 – 1.50 **N** ≥ 0.02

General comments

1.4418 is characterised by its very good resistance to corrosion in aggressive media coupled with very good mechanical and impact properties.

EN 10088-3	1.4418	X4CrNiMo16-5-1
AFNOR	Z6CND16-05-01	
DIN 17440	1.4418	
SIS	2387	

General properties

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

Special properties

can be used to temperatures around 550 °C
ferromagnetic grade
can be used in cryogenic applications

Physical properties

density (kg/dm³)	7.70
electrical resistivity at 20 °C (Ω mm²/m)	0.70
magnetizability	yes
thermal conductivity at 20 °C (W/m K)	15
specific heat capacity at 20 °C (J/kg K)	430
thermal expansion (K^{-1})	20 – 100 °C: 10.8 x 10^{-6}
	20 – 200 °C: 10.8 x 10^{-6}
	20 – 300 °C: 11.2 x 10^{-6}
	20 – 400 °C: 11.6 x 10^{-6}

Typical applications

chemical industry
ship building
mechanical engineering
aviation and aerospace

Note: available from stock
diameters < ø 20 available on request

Processing properties

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

Conditions

annealed, quenched

Demand tendency

rising

Corrosion resistance (PRE = 17.95 – 22.27)

Due to its higher alloy content, 1.4418 is more resistant to corrosion than 1.4057 and the addition of molybdenum allows limited exposure to marine environments. As a result of its chemical composition and microstructure, 1.4418 is extremely resistant to intergranular corrosion, corrosion fatigue and stress corrosion cracking.

Heat treatment and mechanical properties

1.4418 can be soft annealed by holding at a temperature of approximately 600 °C (but not in excess of 625 °C), followed by slow cooling in air. In this condition, the following mechanical properties can be expected:

Property		Specification
tensile strength (N/mm²)	R_m	≤ 1100
hardness	HB	≤ 320

1.4418 can be hardened by holding at a temperature between 1000 °C – 1050 °C followed by cooling in air, oil or polymer.

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The tempering temperature is dependent on the desired strength. Two heat treated conditions are usually specified, namely: QT760 and QT900 (based on the minimum specified tensile strengths). In these conditions, the following mechanical properties can be expected:

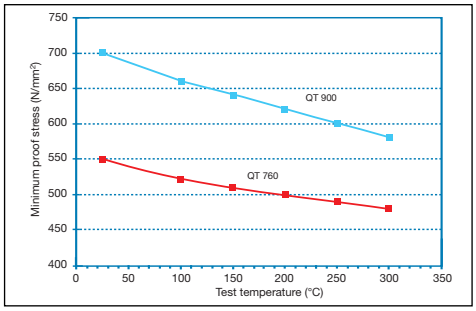
Note: tempering temperatures should be chosen so that the range from 420 °C to 510 °C is rapidly traversed. Before final tempering, the steel must have already cooled throughout to below 40 °C.

Property		Spec. QT760	Typical
yield strength (N/mm²)	$R_{p0.2}$	≥ 550	820
tensile strength (N/mm²)	R_m	760 – 960	940
tensile elongation (%)	A_5	≥ 16	18
impact energy (J) 25°C	ISO-V	≥ 90	

Property		Spec. QT900	Typical
yield strength (N/mm²)	$R_{p0.2}$	≥ 700	920
tensile strength (N/mm²)	R_m	900 – 1100	1050
tensile elongation (%)	A_5	≥ 16	18
impact energy (J) 25°C	ISO-V	≥ 80	

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



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

Welding

1.4418 is readily weldable using all standard welding techniques. Care must however be taken to ensure that hydrogen or carbon containing gasses are not used when welding under shielded gas. Pre-heating of the work piece to a temperature between 100 °C and 200 °C is recommended. After welding, the weldment should either be annealed or tempered, as described before. If a filler material is required, then either a matching filler or Novonit® 4430 should be used.

Forging

Care should be taken when forging 1.4418, since 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 should then take place between 1180 °C – 950 °C followed by cooling is 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. 1.4418 machines similar to carbon steels of the same hardness. Although it must be realised that the machining parameters will vary depending on the heat treated condition and hardness of the steel, the following parameters can be used as a guideline:

	Depth of cut (mm)	6	3	1
	Feed rate (mm/r)	0.5	0.4	0.2
Tempered R_m 900 – 1150 N/mm²	Cutting speed (m/min)	95	100	135

DEUTSCHE EDELSTAHLWERKE GMBH
Auestraße 4
58452 Witten
www.dew-stahl.com

Tel. +49 2302 29 0
Fax +49 2302 29 4000
stainless@dew-stahl.com