# 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.

# 1.4418

**X4CrNiMo16-5-1**

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

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:

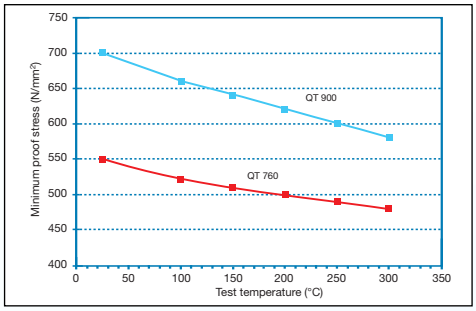
Note: tempering temperatures should be chosen so that the range from 420 °C to 510 °C is rapidly traversed. Before final tempering, the steel must have already cooled throughout to below 40 °C.

| 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