

1.4104

X14CrMoS17

Chromium ferritic stainless steel with sulphur

C 0.10 – 0.17 Cr 15.50 – 17.50 Mo 0.20 – 0.60 S 0.15 – 0.35

General comments

The machinability of 1.4104 is far superior to that of the ferritic 17% chromium steel, 1.4016 as a result of the controlled sulphur addition to this grade of steel. The addition of sulphur however reduces the resistance to corrosion, and as such 1.4016 is significantly more resistant to corrosion than 1.4104, despite their similar chromium contents. It should be noted that as a result of the sulphur addition, neither minimum impact properties, nor elevated temperature properties are specified.

Relevant current and obsolete standards

EN 10088-3	1.4104	X14CrMoS17
AISI	430F	
JIS	430F	
AFNOR	Z13CF17	
DIN 17440	1.4104	
SIS	2383	

General properties

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

Special properties

ferromagnetic grade with good machinability

Physical properties

density (kg/dm ³)	7.70
electrical resistivity at 20 °C (Ω mm ² /m)	0.70
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: 10.0 x 10 ⁻⁶ 20 – 200 °C: 10.5 x 10 ⁻⁶ 20 – 300 °C: 10.5 x 10 ⁻⁶ 20 – 400 °C: 10.5 x 10 ⁻⁶

Typical applications

automotive industry
decorative applications and kitchen utensils
electronic equipment

Note: available from stock

Processing properties

automated machining	yes
machinable	yes
hammer and die forging	seldom
cold forming	yes
cold heading	not common
suited to polishing	no

Conditions

annealed, tempered

Demand tendency

rising

Corrosion resistance (PRE = 16.16 – 19.48)*

Although 1.4104, contains 17 % chromium, the corrosion resistance of this steel is severely compromised by the addition of sulphur. This is particularly true when exposed to environments that promote pitting and crevice corrosion.

*The range of PRE values that are possible for this grade of steel thus have to be viewed with some scepticism since the detrimental effects of sulphur are not taken into account in the determination of PRE values.

Heat treatment and mechanical properties

1.4104 may be annealed to a fully soft structure by holding the steel or component at a temperature of 800 °C followed by slow cooling in air. Care must however be taken to ensure that a temperature of 825 °C is not exceeded during annealing. In this condition, the following mechanical properties can be expected:

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Property		Specification
tensile strength (N/mm ²)	R _m	≤ 730
tensile elongation	A ₅	≤ 15

Note: the HB values could be 60 units higher and the tensile strengths 150 N/mm² higher due to cold work during straightening of profiles ≤ 35 mm.

The mechanical properties may be improved by quenching and tempering, in which the steel is first hardened by holding the steel at a temperature between 950 °C and 1070 °C followed by quenching in air, oil or polymer. The tempering temperature is dependent on the desired strength. In most cases, the QT650 condition is specified and may be obtained by following the hardening treatment with a tempering treatment in the temperature range 550 to 650 °C / air cooled. In this condition, the following mechanical properties can be expected:

Property		Spec. QT650	Typical
yield strength (N/mm ²)	R _{p0.2}	≥ 500	525
tensile strength (N/mm ²)	R _m	650 – 850	725
tensile elongation (%)	A ₅	∅ ≤ 60: ≥ 12 ∅ > 60: ≥ 10	19

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

Welding In general, 1.4104 is not welded, other than occasionally being friction or resistance welded.

Forging As a result of the high sulphur content and mixed ferrite-austenite structure that exists at the forging temperatures, care should be taken when forging 1.4104. When forging is to be performed, gradual heating to a temperature of about 850 °C is recommended prior to more rapid heating to a temperature of between 1100 °C and 1130 °C. Forging then takes place between 1130 °C – 1050°C.

Machining The machinability of this grade of stainless steel is superior to other 12 and 17 % chromium steels as a result of the sulphur addition. When machining 1.4104, the following parameters can be used as a guideline:

1. Turning CNC

	Depth of cut (mm)	6	3	1
	Feed rate (mm/r)	0.5	0.4	0.2
Annealed R_m 650 – 720 N/mm²	Cutting speed (m/min)	250	300	380

2. Automated machining

	Depth of cut (mm)	6	3	1
	Feed rate (mm/r)	0.5	0.4	0.2
Annealed R_m 650 – 720 N/mm²	Cutting speed (m/min)	140	155	165
Tempered R_m 730 – 790 N/mm²	Cutting speed (m/min)	125	140	150