Ferritic Corrosion Resisting Steel

Material Data Sheet

Steel Designation:	Name	Material No.
	X6Cr17	**1.4016**

Scope

This data sheet applies to hot and cold-rolled sheets/plates and strip, semi-finished products, rods, wire, sections and bright products for general purposes.

Application

Rail and road vehicles; container building; warehouse and transport devices for the sugar industry; sound absorber; coal mining. The steel is resistant to intergranular corrosion.

Chemical composition (heat analysis in %)

Product form	C	Si	Mn	P	S	N	Cr	Mo	Ti
C, H, P	≤ 0.08	≤ 1.00	≤ 1.00	≤ 0.040	≤ 0.015[1)]	-	16.0-18.0	-	-
L	≤ 0.08	≤ 1.00	≤ 1.00	≤ 0.040	≤ 0.030[1)]	-	16.0-18.0	-	-

C = cold-rolled strip; H = hot-rolled strip, P = hot-rolled sheet; L = semi-finished products, rods, wire and sections

1) Particular ranges of sulphur content may provide improvement of particular properties. For machinability a controlled sulfur content of 0.015 % to 0.030 % is recommended and permitted. For weldability, a controlled sulfur content of 0.008 % to 0.030 % is recommended and permitted. For polishability, a controlled sulfur content of 0.015 % max. is recommended.

Mechanical properties at room temperature in the annealed condition

Product form	Thickness *t* or diameter[5)] *d* mm max.	Yield strength $R_{p0,2}$		Tensile strength R_m	Elongation min. in %	
		N/mm² min.	N/mm² min.	N/mm²	$A_{80\ mm}$[1)] < 3 mm thickness	A[2)] ≥ 3 mm thickness
		(longitudinal)	(transverse)		(longitudinal and transverse)	(longitudinal and transverse)
C	8	260	280	450 until 600	20	
H	13,5	240	260		18	
P	25[3)]	240	260	430 until 630	20	
L[4)]	100	240	-	400 until 630	20 (longitudinal)	

1) Values apply for test pieces with a gauge length of 80 mm and a width of 20 mm, test pieces with a gauge length of 50 mm and a width of 12,5 mm can also be used.

2) Values apply for test pieces with a gauge length of $5{,}65\sqrt{S_o}$.

3) For thicknesses above 25 mm the mechanical properties can be agreed.

4) For rolled wires, only tensile strength values apply.

5) Width across flats for hexagon.

.

Minimum values of the 0.2 %-Yield strength of ferritic steels at elevated temperatures

Product	Heat treatment condition[1)]	0,2 %-Yield strength at the temperature °C						
		100	150	200	250	300	350	400
		N/mm² min.						
C, H, P, L	+A	220	215	210	205	200	195	190

1) +A = annealed

Reference data on some physical properties

Density at 20 °C	Modulus of elasticity kN/mm² at			Thermal conductivity at 20 °C	Specific thermal capacity at 20 °C	Specific electrical resistivity at 20 °C
kg/dm³	20 °C	200 °C	400 °C	W/m K	J/kg K	Ω mm²/m
7,7	220	210	195	25	460	0,60

Linear coefficient of thermal expansion 10^{-6} K^{-1} between 20 °C and

100 °C	200 °C	300 °C	400 °C	500 °C
10,5	11,0	11,5	12,0	12,0

Guidelines on the temperature for hot forming and heat treatment[1)]

Product form	Hot forming		Heat treatment		
	Temperature	Type of cooling	Annealing [2)]	Type of cooling	Microstructure
C, H, P	1100 – 800 °C	air	770 - 830 °C	air, water	Ferrite
L	1100 – 800 °C	air	770 - 850 °C	air, water	Ferrite

1) Temperature of annealing shall be agreed for simulated heat-treated test pieces.
2) If heat treatment is carried out in a continuous furnace, the upper part of the range specified is usually preferred, or even exceeded.

Processing / welding

Standard welding process for steel grades are:

TIG-welding
MAG-welding solid wire
MAG-welding cored wire
Arc welding (E)
Submerged arc welding (SAW)

Process	**Filler metal**	
	similar	higher alloyed
TIG	Thermanit 17	Thermanit JE-308L
MAG solid wire	Thermanit 17	Thermanit JE-308L Si
MAG cored wire	Thermanit 17	Thermanit TG 308L Thermanit TG 308L-PW
Arc welding(E)	Thermanit 17	Thermanit JEW 308L-17
SAW	Thermanit 17	Thermanit JE-308L

This steel can be weld well by all types of welding-processes (except gas-welding).

Processing

Cold deformation with low amount of deformation is easily feasible above room temperature. Sharp chamfers parallel to the direction of rolling have to be avoided. Sheets with greater thicknesses and/or higher amount of deformation should be preheated up to 200 - 400 °C. If applicable, a hot forming at 700 - 900 °C can be necessary.

The corrosion resistance is affected by annealing colors, which occur after hot forming or welding, or scalings. These have to be removed by pickling (pickling solution), grinding or sand blasting. It is only allowed to use iron-free tools for these workings.

Machining does not differ from machining of non-alloy carbon steels with comparable or corresponding strength.

Remark

According to DIN EN 10095, Appendix D material 1.4016 is deemed to be heat resisting.

Editor

THYSSENKRUPP MATERIALS INTERNATIONAL GMBH
Technical Sales / Quality Management)
Am Thyssenhaus 1
45128 Essen

References

DIN EN 10088-2 : 2005-09
DIN EN 10088-3 : 2005-09
DIN EN 10095:1999-05
Böhler Schweisstechnik Deutschland GmbH, Hamm

Important note

Information given in this data sheet about the condition or usability of materials respectively products are no warranty for their properties, but act as a description.

The information, we give on for advice, comply to the experiences of the manufacturer as well as our own.
We cannot give warranty for the results of processing and application of the products.