Ferritic Heat Resisting Steel

Material Data Sheet

Steel Designation:	Name	Material No.
	X10CrAlSi7	**1.4713**

Scope

This data sheet applies for hot and cold rolled sheet and strip, semi-finished products, bars, rods and sections.

Application

For constructions parts, which should be resistant to scaling up to about 800 °C and extensively inured to the effects of sulfureous gases. The inclination to carburization in reduced gases is very low.

Chemical composition (heat analysis in %)

Product form	C	Si	Mn	P	S	Cr	Al
C, H, P, L	≤ 0,12	0,50-1,00	≤ 1,00	≤ 0,040	≤ 0,015	6,00-8,00	0,50-1,00

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

Mechanical properties at room temperature in the annealed condition

Product form	Thickness *a* or diameter *d* mm	HB max. [1)2)3)]	Proof strength[3)] $R_{p1,0}$ N/mm²min	Proof strength[3)] $R_{p0,2}$ N/mm²min	Tensil strength[1)] R_m N/mm²	Elongation A % min. Long products[3)]	Elongation A % min. Flat products 0,5 ≤ *a*/*d* < 3	Elongation A % min. Flat products 3 ≤ *a*/*d*	
C,H,P	*a* ≤ 12	192	220	-	420 - 620	20	-	20[4)]	15[5)]
L	*d* ≤ 25								

1) The maximum HB values may be raised by 100 units or the maximum tensile strength value may be raised by 200 N/mm² and the minimum elongation value be lowered to 20 % for cold worked sections and bars of ≤ 35 mm thickness.

2) For guidance only.

3) For rod, only the tensile values apply.

4) Longitudinal test piece

5) Transverse test piece

Estimated average values about the long-term behaviour at elevated temperatures (for guidance only)

Temperature °C	1 %-Elongation[1)] for 1000 h N/mm²	1 %-Elongation[1)] for 10 000 h N/mm²	Rupture[2)] for 1000 h N/mm²	Rupture[2)] for 10 000 h N/mm²	Rupture[2)] for 100 000 h N/mm²
500	80	50	160	100	55
600	27,5	17,5	55	35	20
700	8,5	4,7	17	9,5	5
800	3,7	2,1	7,5	4,3	2,3
900	1,8	1,0	3,6	1,9	1,0

1) Stress related to the out put cross-section, which leads after 1000 or 10 000 h to a permanent elongation of von 1 %.

2) Stress related to the out put cross-section, which leads after 1000, 10 000 or 100 000 h to breakage.

Reference data on some physical properties (for guidance only)

Density at 20 °C	Thermal conductivity W/m K at		Specific heat capacity at 20 °C	Electrical resistivity at 20 °C
kg/dm³	20 °C	500 °C	J/kg K	Ω mm²/m
7,7	23	25	450	0,7

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

200 °C	400 °C	600 °C	800 °C	1000 °C
11,5	12,0	12,5	13,0	-

Guidelines on the temperatures for hot forming and heat treatment (for guidance only)

Hot forming		**Heat treatment +A (annealed), Microstructure**		
Temperature °C	Type of cooling	Temperature °C	Type of cooling	Microstructure
1100-750	Air	780 - 840 [1]	Air, Water [2]	Ferrite

[1] If heat treatment is carried out in a continuous furnace, the upper part of the range specified is usually preferred or even exceeded.

[2] In special cases, furnace cooling is also permitted.

Processing / Welding

Standard welding processes for this steel are:

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

Process	**Filler metal**			
	similar		higher alloyed	
TIG	-		Thermanit X / 1.4370	
MAG solid wire	Thermanit 17		Thermanit X / 1.4370	
Arc welding (E)	Thermit 17		Thermanit X / 1.4370	
SAW	Wire	Powder	Wire	Powder
	Thermanit 17	Marathon 213 UA 600	Thermanit X / 1.4370	Marathon 213

Ferritic chrome steels are heat sensitive. Therefore the steel 1.4713 should be welded with lowest possible heat input by using thin electrode diameter, low current intensity and stringer bead welding.

For wall thicknesses under 3 mm, it is not necessary to preheat 1.4713. For thicker construction parts (> 3 mm) the preheating and interpass temperatures 200 – 300 °C should not be under respectively over run.

1.4713 can be processed with similar or higher alloyed filler metals. With sulfureous atmospheres a ferritic top layer should be layed on the media side (Thermanit L 1.4820; MAG and arc welding - Thermanit L; UP: Thermanit with Marathon 213).

Cold forming

When cold forming 1.4713, certain preventive measures should be observed. Sheets up to 3 mm thickness can be cold bended if necessary preheating with 200 - 300 °C should be done.

Products with thicknesses > 3 mm must be preheated up to 600 - 800 °C; concerning machinability 1.4713 can be compared to low carbon steel.

Embrittlement

While heating 1.4713 over about 950 °C, embrittlement by grain growth occurs which can be removed any more.

Note

The material is magnetizable.

Editor

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References

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Important note