Ferritic Heat Resisting Steel

Material Data Sheet

Steel Designation:	Name	Material No.
	X10CrAlSi25	**1.4762**

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 1150 °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	0,70 - 1,40	≤ 1,00	≤ 0,040	≤ 0,015	23,00 - 26,00	1,20 - 1,70

C = cold rolled strip; H = hot rolled strip; P = hot rolled sheet; L = semi-finished products, bars, rolled wire 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	Tensile strength 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	223		280	520 - 720	10	13 [4)5)]	15 [4)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

Creep properties - estimated average values about the long-term behavior at elevated temperature*

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 1 %.

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

* for guidance only

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	17	23	500	1,13

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

200 °C	400 °C	600 °C	800 °C	1000 °C
10,5	11,5	12,0	12,0	13,5

Guidelines on the temperatures for hot forming and heat treatment

Hot forming*		**Heat treatment +A (annealed), Microstructure**		
Temperature °C	Type of cooling	Temperature °C[1)]	Type of cooling[2)]	Microstructure
1100-900	Air	800 - 860	Air, Water	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.

* according to SEW 470

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 D / 1.4829	
MAG solid wire	Thermanit 17 / 1.4015		Thermanit D / 1.4829; L/1.4820	
Arc welding (E)	Thermanit 17 / 1.4015		Thermanit D / 1.4829; L/1.4820	
SAW	Wire	Powder	Wire	Powder
	Thermanit 17 / 1.4015	Marathon 213	Thermanit L / 1.4820	Marathon 213

Ferritic chrome steels are heat sensitive. Therefore the steel 1.4762 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 1.4762. For thicker construction parts (> 3 mm) the preheating and interpass temperatures 200 – 300 °C should not be under respectively over run.

1.4762 can be processed with similar or higher alloyed filler metals. With sulfureous atmospheres a ferritic top layer should be laid on the media side (Thermanit L 1.4820).

Cold forming

When cold forming 1.4762, 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 1.4762 can be compared to low carbon steel.

Embrittlement

While heating 1.4762 over about 950 °C embrittlement by grain growth occurs, which can be removed any more.

A further embrittlement occurs in the temperature range between 400 and 550 °C (475 °C-embrittlement). A longer abidance within this temperature range should be avoided. This loss of ductility can be corrected by a short heating up to 700 and 800 °C.

In the temperature range of 600 to 900 °C 1.4762 has the affinity to sigma-phase-embrittlement, so that after longer application within this temperature range the ductile values are strongly reduced. The steel should not come into operation within this temperature range, if mechanical stress is existent.

Remark

The material is magnetizable.

Editor

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References

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Important note