SÜDWESTFALEN
Edelstahlwerke Südwestfalen GmbH

C: **max. 0,08**
Cr: **17,0 - 19,0**
Ni: **9,0 - 12,0**
Ti: **≥ 5C (max. 0,7)**

1.4541
X6CrNiTi 18-10

1.4541

Chromium-nickel austenitic stainless steel stabilised with titanium

Relevant current and obsolete standards:
- EN 10088-3 : 1.4541 X6CrNiTi 18-10
- AISI : 321
- BS : 321 S51
- JIS : 321
- AFNOR : Z6CNT 18-10
- DIN 17440 : 1.4541
- SIS : 2337
- Luftfahrt : WL 1.4544

Special grade for particular use

–

General properties

– corrosion resistance	: good
– mechanical properties	: average
– forgeability	: average
– weldability	: excellent
– machinability	: poor

Special properties

- non-magnetic grade ($\mu_r \leq 1{,}3$)
- Suitable for use up to 850°C

Physical Properties

– density (kg/dm^3)	: 7,9
– electrical resistivity at 20°C (Ω mm^2/m)	: 0,73
– magnetisability	: slight
– thermal conductivity at 20°C (W/m K)	: 15
– specific heat capacity at 20°C (J/kg K)	: 500
– coefficient of thermal expansion ($10^{-6}K^{-1}$)	
between 20 and 100°C	: 16,0
20 and 200°C	: 16,5
20 and 300°C	: 17,0
20 and 400°C	: 17,5
20 and 500°C	: 18,0

Typical applications
- automotive industry
- building and construction industry
- chemical industry
- food and beverage industry
- aviation and aerospace
- mechanical engineering

Note: - available from stock
- supplied in accordance with the Z-30.3-6 building regulation

Processing

– automated machining	: no
– machinable	: yes
– hammer and die forging	: yes
– cold forming	: yes
– cold heading	: yes
– suited to polishing	: no

Finished product forms and conditions
- wire rod
- peeled bars ∅ 20 - 80
- bright bar h9, ∅ 2 - 80
- bright coils h9, ∅ 0,8 - 20
- solution annealed and quenched
- pickled
- drawn
- straightened
- peeled
- ground

Demand tendency ↓

Revision No. 4541-0
Created: 21.02.2000

Properties, applications and processing

Corrosion resistance (PRE = 17,0 to 19,0)

1.4541 displays excellent resistance to corrosion in most natural waters (rural and industrial), provided the chloride, salt and concentrations of hydrochloric and organic acids are low.
Since this grade of stainless steel is still resistant to intergranular corrosion after welding, i.e. in the sensitised condition, corrosion testing in accordance with the following corrosion testing specifications, are sufficient to establish resistance to corrosion:

AFNOR NF 05-159
ASTM A262-75. Practice E
DIN EN ISO 3651-2

Resistance to high temperature exposure

The following maximum temperatures for continuos exposure to elevated temperature should be adhered to:
- 850°C in oxidising atmospheres
- 750°C in oxidising atmospheres that contain sulphur.

Heat treatment / mechanical properties

Optimal mechanical and fabrication properties are realised after solution annealing in the temperature range 1075 - 1125°C followed by rapid cooling in air or water.
In the solution annealed condition, the following mechanical properties are typical.

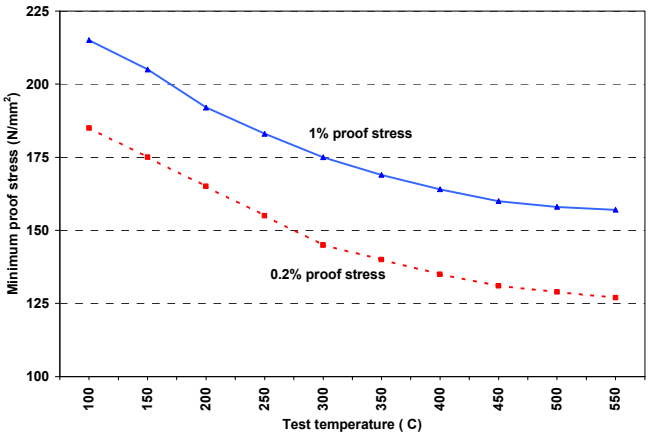
Property	Specification	Typical
- yield strength (N/mm^2)	$R_{p0,2}$: ≥ 190	320
- tensile strength (N/mm^2)	R_m : 500 – 700	600
- tensile elongation (%)	A_5 : ≥ 40	48
- hardness	HB : ≤ 215	200
- impact energy (J) @ 25°C	ISO-V : ≥ 100	200

Welding

1.4541 is weldable with all processes, except gas welding, either with or without the use of filler material. If the use of a filler metal is required, then the use of **Novonit® 4316** or **4551** would be recommended. Post weld heat treatment is not necessary. Maximum inter-pass temperature 200°C. Any heat tint that forms must be removed by pickling or suitable mechanical process followed by passivating to restore corrosion resistance.

Elevated temperature properties

Apart from its good corrosion resistance, **1.4541** is characterised by its high strength at elevated temperatures. The following minimum tensile properties at various temperatures are specified in the EN 10088-3 : 1995 standard.



Forging

Usually heated to within the range 1150 - 1180°C to allow forging which takes place at temperatures between 1180 und 950°C. Forging is followed by water.

Machining

The formation of titanium carbo-nitrides in **1.4541** alters the machinability of this stainless steel compared with the low carbon, titanium free variants, like **1.4307**. The following cutting parameters are thus proposed as a guideline when using coated hard metal cutting tools.

Tensile strengths R_m in N/mm^2	Depth of cut (mm) Feed rate (mm/rev)		
	6 mm 0,5 mm/r	3 mm 0,4 mm/r	1 mm 0,2 mm/r
solution annealed (590 - 650)	95 m/min	100 m/min	135 m/min

General comments:

Due to advances in the production of stainless steels, low carbon variants (**1.4307**) have replaced the titanium stabilised grades of stainless steel. In addition to minimising the possibility of sensitisation during welding or high temperature processing, the low carbon (≤ 0.03%C) grades have overcome the poor surface problems commonly experienced with the titanium stabilised grades. Despite this, continues to be used as a 'traditional' stainless steel grade. It should also be noted that the corrosion resistance is no better or worse than the low carbon variant **1.4307**.

Revision No. 4541-0
Created: 21.02.2000