SÜDWESTFALEN
Edelstahlwerke Südwestfalen GmbH

C: **max. 0,02**
Cr: **19,0 - 21,0**
Ni: **24,0 - 25,5**
Mo: **4,5 - 5,0**
Cu: **1,2 - 1,8**

1.4539
X1NiCrMoCu 25-20-5

1.4539

Stainless super austenitic, nickel-chromium-molybdenum-copper steel with extra low carbon content

Relevant current and obsolete standards:
- EN 10088-3 : 1.4539 X2NiCrMoCu 25-20-5
- AISI : 904 L
- BS : -
- JIS : -
- AFNOR : Z2NCDU 25-20
- DIN 17440 : 1.4539
- SIS : 2562
- SEW 400 : 1.4539

General properties
- corrosion resistance : excellent
- mechanical properties : good
- forgeability : average
- weldability : good
- machinability : with care

Special properties
- non-magnetic grade ($\mu_r \leq 1{,}3$)
- suitable for use up to 400°C
- suitable for use down to -60°C

Physical Properties
- density (kg/dm^3) : 8,05
- electrical resistivity at 20°C (Ω mm^2/m) : 1,0
- thermal conductivity at 20°C (W/m K) : 12
- specific heat capacity at 20°C (J/kg K) : 450
- thermal expansion ($10^{-6}K^{-1}$)
  between 20 and 100°C : 15,8
  20 and 200°C : 16,1
  20 and 300°C : 16,5
  20 and 400°C : 16,9
  20 and 500°C : 17,3

Typical applications
- building and construction industry
- chemical industry
- wrist watch and jewellery components
- ship building
- medical and pharmaceutical applications
- pulp and paper industry

Hint - supplied in accordance with the Z-30.3-6 building regulation

Processing properties
- automated machining : no
- machinable : yes, with care
- hammer and die forging : yes
- cold forming : yes
- cold heading : not common
- suited to polishing : yes

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

Demand tendency ↑

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Properties, applications and processing

Corrosion resistance (PRE = 32,2 to 39,9)

As a result of the high alloy content of **1.4539**, this stainless steel is far more resistant to corrosion than chromium-nickel-molybdenum based steels. Due to the exceptionally low carbon content, **1.4539** is resistant to intergranular corrosion even after welding.

1.4539 is exceptionally resistant to corrosion in halide environments that promote pitting, crevice and stress corrosion cracking. This stainless steel is also resistant to sea water up to temperatures of about 70°C and many other chemical environments including sulphuric and phosphoric acid solutions.

Example: excellent corrosion resistance in:

Sulphuric acid:

- to 20 °C all concentrations
- to 50°C concentrations below 60% or over 90%.

It must be noted that as a result of a lower molybdenum content, **1.4539** is less resistant to pitting and crevice corrosion in aggressive media than **1.4529**. Main applications of **1.4539** include the production, storage and transportation of sulphuric and phosphoric acids, even in the presence of chloride contamination.

Heat treatment / mechanical properties

Optimal mechanical and fabrication properties are realised after solution annealing in the temperature range 1060 - 1150°C followed by rapid cooling in air or water. Exposure to temperatures in the range 600 to 900°C must be minimised to prevent the formation of brittle and less corrosion resistant intermetallic phases, such as sigma phase. In the solution annealed condition, the following mechanical properties may be attained when testing in the longitudinal direction:

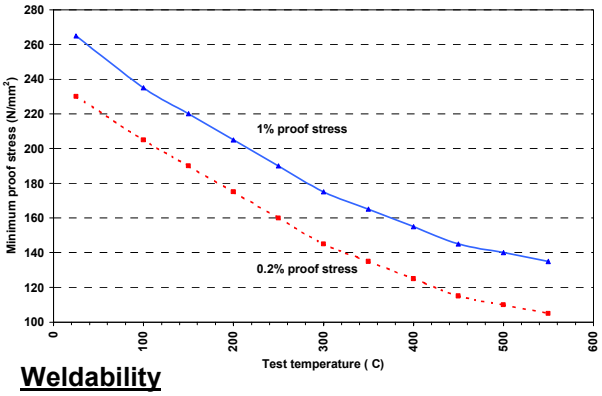
Property	**Specification**
- yield strength (N/mm^2)	$R_{p0,2}$: ≥ 230
- tensile strength (N/mm^2)	R_m : 530 – 730
- tensile elongation (%)	A_5 : ≥ 35
- hardness	HB : ≤ 230
- impact energy (J) @ 25°C	ISO-V : ≥ 100

Forging

Work pieces are usually pre-heated to between 1150 - 1180°C with forging taking place between 1180 and 950°C. After forging, the forged component must be rapidly cooled in air, or water when no danger of distortion exists.

Elevated temperature properties

The following minimum tensile properties at various temperatures are specified in the EN 10088-3 : 1995 standard.



Weldability

1.4539 displays a tendency towards hot cracking, but is otherwise readily weldable using all welding processes. Welding without the use of a filler metal is not recommended since this will promote the tendency for hot crack formation. When using matching filler materials, care must be taken to limit the heat input to low values which could result in lack of, or poor fusion. Weaving during welding must also be avoided to minimise the heat input. The best solution is to make use of a duplex filler material such as **Novonit® 4462** which displays improved high temperature ductility properties. It must however be noted that the use of a duplex filler material will result in a ferromagnetic weld which will have different corrosion properties to the parent metal. A nickel base welding consumable such as **Novonit® 625** could also be considered. In all cases the inter-pass temperature should not exceed 150°C.

Heat treatment after welding is not necessary, and even large sections are resistant to intercrystalline corrosion after welding, due to the low carbon content.

Machining

Due to its high alloy content, **1.4539** can only be machined with difficulty. The following machining parameters can be used as a guideline when machining **1.4539** using a coated hard metal cutting tool.

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 (560 - 640)	110 m/min	125 m/min	150 m/min