1.4306

X2CrNi19-11

Chromium-nickel austenitic stainless steel with low carbon content

C max. 0.03 **Cr** 18.00 – 20.00 **Ni** 10.00 – 12.00

General comments

1.4306 is essentially a more highly alloyed version of 1.4307. Due to the slightly higher chromium and notably higher nickel content, 1.4306 is more corrosion resistant than 1.4307. Despite its improved corrosion resistance, 1.4306 finds itself in a diminishing market as far as profiles is concerned. A possible reason for this could be that most profiles are subjected to further processing by machining and to date no NIRO-CUT® version exists. Most customers thus specify either 1.4307 or 1.4404, when improved corrosion resistance is required.

Relevant current and obsolete standards

EN 10088-3	1.4306	X2CrNi19-11
AISI	304L	
UNS	S30403	
BS	304S11	
JIS	SUS304L	
AFNOR	Z3CN19-11	
DIN 17440	1.4306	
SIS	2352	

Special grades for particular applications

cold heading grade	DIN EN 10263-5
drawing grades	
fine wire grade	
ultra fine wire grade	

General properties

corrosion resistance	good
mechanical properties	poor
forgeability	very good
weldability	excellent
machinability	poor

Special properties

resistant to scaling up to around 600 °C
suited for cryogenic applications
non-magnetic grade ($\mu_r \leq 1{,}3$)
can be readily cold formed

Physical properties

density (kg/dm³)	7.90
electrical resistivity at 20 °C (Ω mm²/m)	0.73
magnetizability	no
thermal conductivity at 20 °C (W/m K)	15
specific heat capacity at 20 °C (J/kg K)	500
thermal expansion (K^{-1})	20 – 100 °C: 16.0 x 10^{-6}
	20 – 200 °C: 16.5 x 10^{-6}
	20 – 300 °C: 17.0 x 10^{-6}
	20 – 400 °C: 17.5 x 10^{-6}
	20 – 500 °C: 18.0 x 10^{-6}

Typical applications

automotive industry
chemical industry*
food and beverage industry
mechanical engineering
decorative items and kitchen utensils
electronic equipment
petrochemical industry

*especially for the production and storage of nitric acid.

Note: diameters greater than 25 mm only available on request
AISI 304L is equivalent to 1.4307, not 1.4306

Processing properties

automated machining	seldom
machinable	yes
hammer and die forging	yes
cold forming	yes
cold heading	yes
suited to polishing	yes

Conditions

solution annealed and quenched

1.4306

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Demand tendency

decreasing

Corrosion resistance (PRE = 18.0 – 20.76)

Due to the low carbon content of 1.4306, there is virtually no tendency for the formation of chromium carbides and the associated chromium depleted regions that would form around these precipitates. Resistance to intergranular corrosion is thus far superior to higher carbon containing grades, such as 1.4301.
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 is thus sufficient to establish resistance to corrosion:
AFNOR NF 05-159 – ASTM A262-75. Practice E – DIN EN ISO 3651-2

1.4306 is resistant to corrosion in most natural waters and urban and rural atmospheres, provided that the chloride and salt contents are low. This grade of stainless steel is not resistant to sea water and as such must not be used in any sea water applications. As with 1.4307, this steel is not suited for use in swimming pools or swimming pool environments. Resistance to reducing acids is also confined to low concentrations and low temperatures.

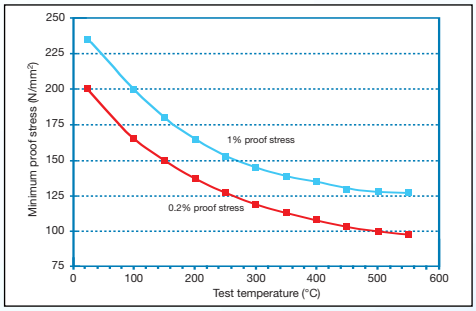
Heat treatment and mechanical properties

Optimal material properties are realised after solution annealing in the temperature range 1000 °C – 1100 °C followed by rapid cooling in air or water. During operation and fabrication, the time spent in the temperature range 450 °C – 850 °C must be minimised to avoid embrittlement. In the solution annealed condition, the following mechanical properties may be attained:

Property		Specification	Typical
yield strength (N/mm²)	$R_{p0.2}$	≥ 180	345
tensile strength (N/mm²)	R_m	460 – 680	640
tensile elongation (%)	A_5	≥ 45	50
hardness	HB	≤ 215	195
impact energy (J) 25 °C	ISO-V	≥ 100	225

The mechanical properties (d ≥ 160 mm) have to be agreed on for thicker dimensions, or the delivered product is based on the values given.

Elevated temperature properties



Minimum tensile properties at various temperatures, shown in the diagramm, are specified in the EN 10088-3: 1995 standard, are exactly the same as for 1.4307.

Welding

1.4306 is weldable with or without the use of filler material, but is more readily welded when using a filler material. The use of Novonit® 4316 (AISI 308L) as the preferred filler metal is recommended. Post weld heat treatment is not necessary.

Forging

1.4306 is usually slowly heated to within the temperature range 1150 °C – 1180 °C to allow forging which takes place at temperatures between 1180 °C and 950 °C. Forging is followed by air cooling, or water quenching when no danger of distortion exists.

Machining

Although 1.4306 has a low carbon content, which reduces the tendency to work harden when machined, the machinability of this grade of steel is inferior to the NIRO-CUT® variants which are available for 1.4307. When machining 1.4306, the following cutting parameters can be used as a guideline when using coated hard metal cutting tools.

Turning CNC

	Depth of cut (mm)	6	3	1
	Feed rate (mm/r)	0.5	0.4	0.2
Solution annealed R_m 520 – 600 N/mm²	Cutting speed (m/min)	140	210	260

DEUTSCHE EDELSTAHLWERKE GMBH
Auestraße 4
58452 Witten
www.dew-stahl.com

Tel. +49 2302 29 0
Fax +49 2302 29 4000
stainless@dew-stahl.com

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