

TECHNICAL DATA

10.11 Stainless Steel characteristics

AISI Standard	301	302	303	304	304 Cu
German Material No.	1.4310	1.4325	1.4305	1.4301	1.4567
DIN / EN-Number	EN 10088-3	EN 10088-1	EN 10088-3	EN 10088-3	EN 10088-3
Symbol	X 10 CrNi 18-8	X9CrNi 18-9	X 8 CrNiS 18-9	X 5 CrNi 18-10	X 3 CrNiCu 18-9-4
Alloying components %	C ≤ 0.05 ... 0.15 Mo ≤ 0.8 Cr 16.0 ... 19.0 Ni 6.0 ... 9.5	C ≤ 0.08 Si ≤ 0.6 Mn ≤ 1.2 Cr 18.0 Ni 9.0	C ≤ 0.10 S ≤ 0.15 ... 0.35 Cr 17.0 ... 19.0 Ni 8.0 ... 10.0	C ≤ 0.07 Cr 17.5 ... 19.5 Ni 8.0 ... 10.5	C ≤ 0.04 Cr 17.0 ... 19.0 Ni 8.5 ... 10.5 Cu 3.0 ... 4.0
Minimum tensile strength Rm in N/mm ²	500 ... 750	600 ... 800	500 ... 700	500 ... 700	450 ... 650
Yield strength Rp 0.2 in N/mm ²	≥ 195	≥ 210	≥ 190	≥ 190	≥ 175
Machinability	poor	good	very good	medium	medium ... good
Forgeability	good	poor	poor	good	good
Weldability	excellent	poor	poor	excellent	good
Special characteristics	antimagnetic, austenitic structure usable as spring steel up to 300 °C	Non-magnetic structure. Suitable for low temperatures	antimagnetic, austenitic structure	antimagnetic, austenitic structure suitable for low temperatures, can be used up to 700 °C	antimagnetic, austenitic structure suitable for cold forming
Corrosion resistance	good however, sensitive to intercrystalline corrosion	fair	medium due to the sulphur content reservations in environments which contain acids and chlorides	good resistant to corrosion, in the natural environment: water, rural and urban atmospheres without significant chloride or acid concentrations, in food areas and in agricultural food areas	good resistant to corrosion in the natural environment: water, rural and urban atmospheres without significant acid concentrations, in food areas and in agricultural food areas
Main areas of application	Springs for temperatures up to 300 °C, Tools (knives), Plates for vehicle construction, Chemical and food industry	Used for the manufacture of springs in various fields of application	Vehicle construction, Electronics, Decorative purposes (Kitchen equipment), Machine construction	Food industry, Agriculture, Chemical industry, Vehicle construction, Construction industry, Machine construction, Decorative purposes (Kitchen equipment)	Food industry, Agriculture, Chemical industry, Machine construction, Shipbuilding, Electronics, Screw industry

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AISI Standard	316	316 Precision casting	316 Precision casting	316L (bar steel)	316 LHC Sintered Material
German Material No.	1.4401 (A4)	1.4405	1.4408	1.4404	1.4404
DIN / EN-Number	EN 10088-3	EN 10213-4	EN 10213-4	EN 10088-3	Sint C40
Symbol	X 5 CrNiMo 17-12-2	GX 4CrNiMo16-5-1	GX 5 CrNiMo 19-11-2	X 2 CrNiMo 17-12-2	X 2 CrNiMo 17-13-2
Alloying components %	C ≤ 0.07 Cr 16.5 ... 18.5 Ni 10.0 ... 13.0 Mo 2.0 ... 2.5	C ≤ 0.06 Cr 15.0 ... 17.0 Ni 4.0 ... 6.0	C ≤ 0.07 Cr 18.0 ... 20.0 Ni 9.0 ... 12.0 Mo 2.0 ... 2.5	C ≤ 0.03 Cr 16.5 ... 18.5 Ni 10.5 ... 13.0 Mo 2.0 ... 2.5	C ≤ 0.08 Mo 2.0 ... 4.0 Cr 16.0 ... 19.0 Ni 10.0 ... 14.0
Minimum tensile strength Rm in N/mm ²	500 ... 700	760	440 ... 650	500 ... 700	330
Yield strength Rp 0.2 in N/mm ²	≥ 200	≥ 540	≥ 185	≥ 200	≥ 250
Machinability	medium	poor ... medium	medium	medium	–
Forgeability	good	–	–	good	–
Weldability	good	good	good	excellent	–
Special characteristics	antimagnetic, austenitic structure suitable for low temperatures, can be used up to 600 °C	antimagnetic, martensitic structure	antimagnetic, austenitic structure	antimagnetic, austenitic structure suitable for low temperatures, can be used up to 700 °C	antimagnetic structure
Corrosion resistance	very good significantly higher than AISI 304 in natural environmental mediums and moderate chlorine and salt concentrations, however not resistant to ocean water	medium resistant to corrosion, reservations apply particularly in the case of environments with exposure to acid and salt	very good acid-resistant	very good significantly higher than AISI 304 in natural environmental mediums and moderate chlorine and salt concent- rations, however not resistant to ocean water	medium by virtue of its coarser porosity the corrosion resistance is in general reduced as compared with stainless steel, reservations especially in acid and salty environment
Main areas of application	Chemical industry, Food industry, Machine construction, Building industry	Pumps, Valves, Parts for hydropower engineering	Chemical industry, Food industry, Fittings, Pumps, Machine construction	Vehicle construction, Chemical industry, Food industry, Medical / Pharmaceutical industry, Building industry	Paint, oil, soap and textile industry, Electronics, Decorative purposes (Kitchen equipment)

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TECHNICAL DATA

Material characteristics of Stainless Steel continued

AISI Standard	316Ti	431	440C	630	CF-8 Precision casting
German Material No.	1.4571	1.4057	1.4125	1.4542	1.4308
DIN / EN-Number	EN 10088-3	EN 10088-3	EN 10088-3	EN 10088-3	EN 10213-4
Symbol	X 6 CrNiMoTi 17-12-2	X 17 CrNi 16-2	X 105 CrMo 17	X 5 CrNiCuNb 16-4	GX 5CrNi 19-10
Alloying components %	C ≤ 0.08 Mn ≤ 2.0 Cr 16.5 ... 18.5 Ni 10.5 ... 13.5 Mo 2.0 ... 2.5 Ti ≤ 5xC max. 0.7	C ≤ 0.12 ... 0.22 Cr 15.0 ... 17.0 Ni 1.5 ... 2.5	C ≤ 0.95 ... 1.2 Cr 16.0 ... 18.0	C ≤ 0.07 Cr 15.0 ... 17.0 Ni 3.0 ... 5.0 Cu 3.0 ... 5.0 Nb min. 5xC ... 0.45	C ≤ 0.07 Cr 18.0 ... 20.0 Ni 8.0 ... 11.0
Minimum tensile strength Rm in N/mm ²	500 ... 700	800 ... 950	750 ... 1500	800 ... 1200	440 ... 640
Yield strength Rp 0.2 in N/mm ²	≥ 175	≥ 600	-	500 ... 1000	≥ 175
Machinability	medium ... poor	poor	poor ... medium	poor ... medium	medium
Forgeability	medium	medium	-	good	-
Weldability	good	good	poor	good	good
Special characteristics	antimagnetic, austenitic structure, suitable for low temperatures can be used up to 700 °C, high stability even at high temperatures	magnetic, martensitic structure for elements with high stability, can be used up to 400 °C	magnetic, martensitic structure thoroughly heat treatable, high wear resistance	magnetic, martensitic structure suitable for low temperatures, can be used up to 450 °C	antimagnetic, austenitic structure
Corrosion resistance	very good comparable with AISI 316L	good however, sensitive to intercrystalline corrosion	medium freshwater, oil, gasoline, alcohol, dairy products	good comparable with AISI 304, insensitive to intergranular corrosion	good largely comparable with AISI 304
Main areas of application	Equipment and pipeline construction, Chemical industry, Food industry, Medical / pharmaceutical industry, Shipbuilding	Vehicle construction, Chemical industry, Aviation, Machine construction, Food industry	Blades, Surgical cutting instruments Ball bearings, Valves	Shipbuilding, Food industry, Construction engineering, Automotive industry, Chemical industry, Plant construction	Food industry, Beverage industry, Packaging industry, Fittings, Pumps, Agitators

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Technopolymer and Rubber Resistance to chemical agents at 23 °C temperature																											
Chemical agents and solvents	Polyamide (PA)		Trans- parent polyamide (PA-T)		Alcohol- Resistant transparent polyamide (PA-TAR)		Poly- propylene (PP)		Acetal resin (POM)		Poly- carbonate (PC)		Soft-Touch thermoplastic elastomer (TPE)		Rubber NBR		Flourated Rubber FKM		Natural rubber NR								
	Notes	%	Notes	%	Notes	%	Notes	%	Notes	%	Notes	%	Notes		Notes	%	Notes	%	Notes	%							
Acetic acid	Sol.	10	▲	Sol.	10	▲	Sol.	10	□	40	●	Sol.	20	▲	Sol.	10	●		●	▲	□						
Acetone		100	●			□			●		●			▲			●		▲		▲						
Acrylonitrile		100	●			▲			▲					□			▲		▲		▲						
Aluminium chloride	Sol.	10	●			●			●				●		●	Sol.	●	Sol.	●		●						
Aluminium sulphate	Sol.	10	●	Sol.	10	▲	Sol.	10	●	Sol.	50	●		●		●	Sol.	●	Sol.	●	●						
Ammonia gas			□			●			●					□			●		▲		▲						
Ammonia	Sol.	10	●	Sol.	10	●		10	●	Conc.	●			▲		□	Sol.	□	Sol.	▲	▲						
Ammonium chloride	Sol.	10	●	Sol.	10	●	Sol.	10	●		●	Sol.	10	▲		●	Sol.	●	Sol.	●	●						
Amyl alcohol		100	●			▲			●		●			□		●		●		●	●						
Aniline		100	□			▲			▲		●			●		▲	Swell.	▲		●	●						
Beer			●			●			●		●			●		●		●		●	▲						
Benzoic acid	Sol.	Sat.	□	Sol.	10	▲	Sol.	10	□	Sat.	●			up to 60°C	●	Sol.		□	Sol.	●	●						
Benzol/benzene		100	●			●			▲		●			▲		▲		▲		●	▲						
Boiling water	Swell.		□	Swell.		□	Swell.		□				●		□		□		□		▲						
Boric acid	Sol.	10	●			□			□	Sat.	●				●	Sol.	●	Sol.	●		▲						
Butter			●			●			●		●			●		●		●		●	▲						
Butyl acetate		100	●		100	●		100	●		●				□						▲						
Butyl alcohol		100	●			▲			●		●			●		●		●		●	●						
Butylene glycol		100	●			▲			□					□		●		●		●							
Calcium chloride	Sol.	10	●			●			●	Sol.	50	●		●		●	Sol.	●	Sol.	●	●						
Carbon disulphide		100	●			□			●		▲					▲		▲		●	▲						
Carbon tetrachloride			●			□			●		▲			▲		▲		▲		●	▲						
Caustic potash	Sol.	5 - 10	●	Sol.	5 - 10	●	Sol.	5 - 10	●	Sol.	5 - 10	●	Sol.	10	□		●	Sol.	5 - 10	□	Sol.	5 - 10	▲	▲			
Caustic potash	Sol.	50	□	Sol.	50	●	Sol.	50	●	Sol.	50	●				●	Sol.	50	▲	Sol.	50	▲	●				
Chloroform		100	▲			▲			▲		▲			▲		▲		▲		●	●						
Citric acid	Sol.	10	□	Sol.	10	□	Sol.	10	□	10	●		●	Sol.	10	●	up to 60°C	●	Sol.	●	Sol.	●	●				
Copper sulphate	Sol.	10	●						●		●				●	Sol.		Sol.		●	●						
Dichloropropane									□							▲					●						
Distilled water			●			●			●		●			●		●		●		●	▲						
Edible fats			●			●			●		●			●		●		●									
Edible oils			●			●			●		●			up to 60°C	●		●		●		□						
Ethyl acetate		100	●		100	●		100	●		●			▲		□		▲			▲						
Ethyl alcohol (ethanol)		96	●			▲			●	96	●			●		●		□		□	▲						
Ethyl chloride		100	●			▲			▲		▲						●		●								
Ethylene glycol			●			▲			□		●			●		□		●		●	▲						
Ethyl ether			●			●			●		●			▲		▲		□		▲	●						
Ferric chloride	Sol.	10	●			●			●		●			●		●	Sol.	●	Sol.	●	▲						
Formaldehyde (formalin)	Sol.		●	Sol.	40	□	Sol.	40	●	Sol.	40	●			●	Sol.	40	□	Sol.	40	●						
Formic acid	Sol.	10	▲	Sol.		▲	Sol.		▲	Sol.	10	●	100	▲	Sol.	30	□	up to 60°C	●	Sat.		▲					
Freon 11									□			●					●		□		▲						
Freon 12	Liq.		●			●			●		□		●				●		□		▲						
Freon 13									□			●						●		●	●						
Gas oil			●			●			●		●			●		▲		●		●	●						
Gasoline vapor			●			●			●	Swell.	□		●		▲		□		□		●						
Glycerin			●			●			●		●			□		▲		●		●	□						
Green gasoline			●			●			●	Swell.	□		●		▲		▲		□		●						
Hydrochloric acid	Sol.	10	▲	Sol.	10	□	Sol.	10	□	Sol.	30	●	Sol.	10	▲	Sol.	10	●	up to 60°C	●	Sol.	10	□	Sol.	10	●	●
Hydrofluoric acid	Sol.	40	▲	Sol.	10	▲	Sol.	10	▲	Sol.	40	●		▲	Sol.	20	●		□		50	▲	50	●	▲		
Hydrogen peroxide	Sol.	3	▲	Sol.	3	▲	Sol.	3	▲	30	●	Sol.	90	▲	Sol.	30	●		□		Sol.	80	▲	Sol.	80	□	▲
Iodine			▲			▲			▲		●				□		●				●				●		



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Technopolymer and Rubber Resistance to chemical agents at 23 °C temperature

Chemical agents and solvents	Polyamide (PA)	Transparent polyamide (PA-T)	Alcohol-Resistant transparent polyamide (PA-TAR)	Poly-propylene (PP)	Acetal resin (POM)	Poly-carbonate (PC)	Soft-Touch thermoplastic elastomer (TPE)	Rubber NBR	Flourated Rubber FKM	Natural rubber NR
	Notes %	Notes %	Notes %	Notes %	Notes %	Notes %	Notes	Notes %	Notes %	Notes %
Isopropyl alcohol (isopropanol)	●	▲	●	●	●	□	●	□	●	●
Kerosene	●	●	●	□	●	▲	▲	●	●	▲
Lactic acid	Sol. 10 ●	Sol. 10 □	Sol. 10 □	Sol. 20 ●	●	Sol. 10 ●	up to 60°C	Sol. ●	Sol. ●	▲
Light petroleum	●	▲	●	●	●	□	▲	●	●	▲
Linseed oil	●	●	●	●	●	●	up to 60°C	●	●	▲
Magnesium chloride	Sol. 10 ●	●	●	Sol. Sat ●	●	●	●	Sol. ●	Sol. ●	●
Mercuric chloride	Sol. 6 ▲	●	●	●	●	●	●	●	●	●
Mercury	●	●	●	●	●	●	●	●	●	●
Methyl acetate	100 ●	100 ●	100 ●	●	●	●	□	●	●	□
Methyl alcohol	100 ●	▲	●	100 ●	●	▲	●	□	▲	□
Methylene chloride	100 ●	▲	●	□	●	▲	▲	▲	●	●
Methyl ethyl ketone	●	▲	▲	□	▲	▲	▲	▲	▲	●
Milk	●	●	●	●	●	●	●	●	●	▲
Mineral oil	●	●	●	●	●	●	up to 60°C	●	●	●
Nitric acid	10 ▲	Sol. 2 □	Sol. 2 □	Sol. 10 ●	Sol. 10 ▲	Sol. 20 □	□	Sol. 10 □	Sol. □	●
Oleic acid	100 ●	●	●	Sol. ●	●	●	up to 60°C	●	□	●
Paraffin oil	●	●	●	●	●	●	up to 60°C	●	●	□
Phenol	Sol. ▲	▲	▲	●	▲	▲	▲	▲	▲	●
Phosphoric acid	Sol. 10 ▲	▲	▲	Sol. 85 ●	Sol. 10 ▲	Sol. 10 ●	up to 60°C	●	Sol. 20 □	Sol. ●
Potassium nitrate	Sol. 10 ●	Sol. 10 ●	Sol. 10 ●	Sat. ●	●	●	●	●	●	▲
Sea water, river, drinking	●	●	●	●	●	●	●	●	●	●
Silicone oil	●	●	●	●	●	●	●	●	●	●
Silver nitrate	●	Sol. 10 ●	Sol. 10 ●	Sol. 20 ●	●	●	●	Sol. □	●	●
Soap solution	Sol. ●	Sol. ●	Sol. ●	Sol. ●	●	●	●	Sol. ●	Sol. ●	▲
Sodium carbonate	Sol. 10 ●	●	●	Sol. Sat. ●	●	●	●	Sol. ●	Sol. ●	▲
Sodium chloride	Sol. ●	Sol. 25 ●	Sol. 25 ●	Sol. Sat. ●	●	●	●	Sol. ●	Sol. ●	●
Sodium hydroxide	Sol. 5 - 10 ●	Sol. 5 - 10 ●	Sol. 5 - 10 ●	Sol. 5 - 10 ●	Sol. 10 ●	●	●	Sol. 5 - 10 □	Sol. 5 - 10 ▲	●
Sodium hydroxide	Sol. 50 □	Sol. 50 ●	Sol. 50 ●	Sol. 50 ●	●	●	●	Sol. 50 ▲	Sol. 50 ▲	●
Sodium hypochlorite	Sol. ●	▲	▲	Sol. 20 ●	Sol. 5 ▲	Sol. 5 ●	●	Sol. 10 ▲	Sol. 10 ▲	●
Sodium nitrate	Sol. 10 ●	Sol. 10 ●	Sol. 10 ●	●	●	▲	●	●	●	●
Sodium silicate	●	●	●	●	●	●	●	●	●	●
Sodium sulphate	Sol. 10 ●	Sol. 10 ●	Sol. 10 ●	●	●	●	●	Sol. ●	Sol. ●	□
Sulfuric acid	Sol. 10 ▲	Sol. 2 ●	Sol. 2 ●	98 ●	Sol. 10 ▲	Sol. 50 ●	up to 60°C	●	Sol. 20 □	Sol. 20 ●
Tartaric acid	●	Sol. □	Sol. □	Sol. 10 ●	●	●	up to 60°C	●	Sol. ●	Sol. ●
Tetralin	●	●	●	▲	●	▲	▲	▲	▲	□
Toluol/toluene	●	●	●	□	●	▲	▲	▲	□	▲
Transformer oil	●	●	●	□	●	●	up to 60°C	□	●	▲
Trichlorethylene (Trichloroethylene)	□	●	●	▲	●	▲	▲	▲	□	▲
Vaseline	●	●	●	●	●	●	□	●	●	▲
Vinegar	●	●	●	●	●	●	●	□	□	▲
Water vapor	●	●	●	●	●	●	●	□	●	□
Whisky	●	□	●	●	●	●	●	●	●	□
Wine	●	●	●	●	●	●	●	●	●	□
Xylene	●	●	●	▲	●	▲	▲	▲	●	□
Zinc chloride	□	Sol. 50 ●	Sol. 50 ●	Sol. 20 ●	●	●	●	Sol. ●	Sol. ●	▲

● = good resistance
 □ = fair resistance (limited use according to working conditions)
 ▲ = poor resistance (should not be used)
 Blanks stand for data not available

Conc. = concentration
Sol. = solution
Liq. = liquid
Sat. = saturated
Rigont. = swelling

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