outokumpu
high performance stainless steel

Core 304L/4306

EN 1.4306, ASTM TYPE 304L

General characteristics

Core 304L/4306 is a higher nickel alternative to Core 304L/4307 with improved formability and deep drawability. Core 304L/4306 is an austenitic stainless steel that belongs to the standard CrNi stainless steel family. Core 304L/4306 has the variant with 10.5 wt.% nickel for improved formability and low carbon content for improved resistance against intergranular corrosion after welding.

The austenitic CrNi standard grades are the most widely used group of stainless steels. Their well-balanced material properties make them suitable for the fabrication of many products.

Core 304L/4306 is commonly available from many stainless steel stockists in manyproduct forms and dimensions. It can be supplied with a wide range of functional and aesthetic surface finishes.

Typical applications

- Chemical and pharmaceutical plant equipment (mild to medium corrosive environments)
- Flanges and valves

Products & dimensions

Cold rolled products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
2B	Cold rolled, heat treated, pickled, skin passed	0.30-6.35	30-2070	0.30-6.35	300-2070
2BB	Bright-pickled	0.30-3.50	30-1530	0.30-3.50	600-1530
2C	Cold rolled, heat treated	0.50-6.00	30-1530		
2D	Cold rolled, heat treated, pickled	0.30-6.50	10-1630	0.30-6.50	10-1630
2E	Cold rolled, heat treated, mech. desc. pickled	0.30-6.00	30-1650	0.49-6.35	300-2070
2G	Ground	0.30-3.00	30-1500	0.30-3.00	600-1500
2H	Work hardened	0.05-5.00	3-1500	0.40-5.00	600-1500
2J	Brushed or dull polished	0.30-3.00	30-1500	0.30-3.00	600-1500
2K	Satin finish	0.50-4.00	35-1600	0.50-4.00	400-1524
2M	Patterned	0.30-3.50	30-1530	0.30-3.50	600-1530
2R	Cold rolled, bright annealed	0.05-3.50	3-1500	0.30-3.50	350-1500

Continous hot rolled products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
1C	Hot rolled, heat treated, not descaled	2.00-10.00	50-1550		
1D	Hot rolled, heat treated, pickled	2.40-12.70	50-2070	2.40-12.70	50-2070
1E	Hot rolled, heat treated, mech. desc.	1.86-4.50	50-1620		
1G	Ground	2.00-3.00	750-1350	2.00-3.00	750-1350
1M	Patterned	2.00-3.00	750-1350	2.00-3.00	750-1350
1U	Black hot rolled	2.00-10.00	50-1550		

Quarto plate products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
1D	Hot rolled, heat treated, pickled			5.00-130.00	400-3200

Chemical composition

The typical chemical composition for this grade is given in the table below, together with composition limits given for the product according to different standards. The required standard will be fully met as specified on the order.

The chemical composition is given as % by mass.

	C	Mn	Cr	Ni	Mo	N	Other
Typical	**0.02**		**18.2**	**10.1**			
EN 10028-7	≤0.030	≤2.00	18.0-20.0	10.0-12.0		≤0.10	
EN 10088-2	≤0.030	≤2.0	18.0-20.0	10.0-12.0		≤0.10	
EN 10088-3	≤0.030	≤2.00	18.0-20.0	10.0-12.0		≤0.10	
EN 10088-4	≤0.030	≤2.0	18.0-20.0	10.0-12.0		≤0.10	

Corrosion resistance

Core 304L/4306 has excellent corrosion resistance in solutions of many halogen-free organic and inorganic compounds over a wide temperature and concentration range. It can withstand many organic and sufficiently diluted mineral acids depending on the temperature of the solution. Core 304L/4306 may suffer from uniform corrosion in mineral acids and hot strong alkaline solutions. Due to its increased nickel content, its uniform corrosion resistance usually matches or supersedes the corrosion resistance of the basic austenitic CrNi standard grades 4301 and 4307. More detailed information on the corrosion properties of Core 304L/4306 can be found in Outokumpu's Corrosion Tables published in the Outokumpu Corrosion Handbook and on www.outokumpu.com .
Due to its low carbon content, the risk of sensitisation for intergranular corrosion after welding sheets up to 6 mm thick is strongly reduced when compared to other austenitic CrNi standards grades with normal carbon content.

In aqueous solutions containing halogenides, e.g. chlorides or bromides, pitting and crevice corrosion may occur depending on halogenide concentration, temperature, pH-value, concentration of oxidizing compounds, or crevice geometry, if applicable. For a short period of time, for instance during cooking of food in stainless steel dishes, Core 304L/4306 can tolerate even relatively high chloride concentrations. The presence of corrosion-inhibiting or accelerating compounds like e.g. transition metal ions or organic compounds may influence the corrosion behaviour of grade Core 304L/4306.

More information is available in Outokumpu Corrosion Handbook.

Pitting corrosion resistance		Crevice corrosion resistance
PRE	CPT	CCT
18	<10	<0

Pitting Resistance Equivalent (PRE) is calculated using the following formula: PRE = %Cr + 3.3 x %Mo + 16 x %N
Corrosion Pitting Temperature (CPT) as measured in the Avesta Cell (ASTM G 150), in a 1M NaCl solution (35,000 ppm or mg/l chloride ions).
Critical Crevice Corrosion Temperature (CCT) is obtained by laboratory tests according to ASTM G 48 Method F

Mechanical properties

The mechanical properties of the available products are given in the table below. In addition to these values, several of the chromium-nickel grades are available in the temper rolled condition with higher mechanical strength. Please contact your local Outokumpu sales company for more information.

Cold rolled coil and sheet	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Elongation[1)] %	Impact strength J	Rockwell	HB	HV
Typical (thickness 1 mm)	**255**	**285**	**585**	**70**				
EN 10028-7	≥ 220	≥ 250	520 - 700	≥ 45				
EN 10088-2	≥ 220	≥ 250	520 - 700	≥ 45				
EN 10088-4	≥ 220	≥ 250	520 - 700	≥ 45				

Hot rolled coil and sheet	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Elongation[1)] %	Impact strength J	Rockwell	HB	HV
Typical (thickness 4 mm)	**255**	**315**	**580**	**55**			**160**	
EN 10028-7	≥ 220	≥ 250	520 - 700	≥ 45				
EN 10088-2	≥ 220	≥ 250	520 - 700	≥ 45				
EN 10088-4	≥ 220	≥ 250	520 - 700	≥ 45				

Hot rolled quarto plate	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Elongation[1)] %	Impact strength J	Rockwell	HB	HV
Typical (thickness 15 mm)	**240**	**270**	**580**	**55**				
EN 10028-7	≥ 200	≥ 240	500 - 700	≥ 45				
EN 10088-2	≥ 200	≥ 240	500 - 700	≥ 45				
EN 10088-4	≥ 200	≥ 240	500 - 700	≥ 45				

Wire rod	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Elongation[1)] %	Impact strength J	Rockwell	HB	HV
Typical	**280**	**320**	**580**	**55**				

[1)]Elongation according to EN standard:
A_{80} for thickness below 3 mm.
A for thickness = 3 mm.
Elongation according to ASTM standard $A_{2"}$ or A_{50}.

Physical properties

Physical properties. Values according to EN 10088

Density kg/dm^3	Modulus of elasticity GPa	Thermal exp. at 100 °C 10^{-6}/°C	Thermal conductivity W/m°C	Thermal capacity J/kg°C	Electrical resistance µΩm	Magnetizable
7.9	200	16,0	15	500	0.73	No

Fabrication

Cold forming

Core 304L/4306 can be readily formed and fabricated using a full range of cold forming operations. It can be used in heading, drawing, and bending. Any cold forming operations will increase the strength and hardness of the material and may leave it slightly magnetic. Work hardening is aaccentuated by the partial transformation of the austenite phase of the material to hard martensite.

Hot forming

Hot forming can be carried out in the 850 °C–1150 °C range. For maximum corrosion resistance, forgings should be annealed at 1050 ° C and rapidly cooled in air or water after hot forming operations.

Welding

Core 304L/4306 has excellent weldability and is suitable for the full range of conventional welding methods (like MMA, MIG, MAG, TIG, SAW, LBW, or RSW), except gas welding. Core 304L/4306 has about 50% higher thermal expansion and lower heat conductivity compared to carbon steels. This means that larger deformation and higher shrinkage stresses may result from welding.

In thin sections, autogenous welding may be used. To ensure that the weld metal properties (e.g. strength, corrosion resistance) are equivalent to those of the parent metal, matching or slightly overalloyed fillers should preferably be used. The recommended filler metal is 19 9 L.
Post-weld heat treatment is generally not required. In special cases where there is high risk of stress corrosion cracking or fatigue, stress relief treatment may be considered.

In order to fully restore the corrosion resistance of the weld seam, the weld discoloration should be removed by pickling and passivation.

Because of the austenitic structure, the welded joints are tough down to low temperatures even in the as-welded condition.

More detailed information concerning welding procedures can be obtained from the Outokumpu Welding Handbook, available from our sales offices.

Standards & approvals

The most commonly used international product standards are given in the table below.

Standard	Designation
EN 10028-7, PED 2014/68/EU	1.4306
EN 10088-2	1.4306
EN 10088-3	1.4306
EN 10088-4	1.4306

Contacts & Enquiries

Contact your nearest sales office

www.outokumpu.com/contacts

Working towards forever.

We work with our customers and partners to create long lasting solutions for the tools of modern life and the world's most critical problems: Clean energy, clean water and efficient infrastructure. Because we believe in a world that lasts forever.

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