

# Core 304/4301

EN 1.4301, ASTM TYPE 304 / UNS S30400

## General characteristics

Core 304/4301 is a classic 18% chromium, 8% nickel austenitic stainless steel. It's an all-purpose product with good corrosion resistance and is suitable for a wide variety of applications that require good formability and weldability. Core 304/4301 can be delivered with a variety of surface finishes.

Core 304/4301 is an austenitic stainless steel, which belongs to the standard CrNi stainless steel family. Core 304/4301 is the basic variant with normal carbon and nickel content.

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 304/4301 is commonly available from many stainless steel stockists in many product forms and dimensions. It can be supplied with a wide range of functional and aesthetic surface finishes.

## Typical applications

- Household appliances and consumer goods
- Kitchen equipment
- Indoor and outdoor cladding, handrails, and window frames
- Food and beverage industry equipment
- Storage tanks
- 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	0.25-6.35	12-2070	0.25-6.35	18-2070
2BB	Bright-pickled	0.25-3.50	30-1524	0.25-3.50	350-1530
2C	Cold rolled, heat treated	0.40-6.00	30-1540	0.40-3.20	400-1500
2D	Cold rolled, heat treated, pickled	0.30-6.35	30-1610	0.30-6.35	35-1610
2E	Cold rolled, heat treated, mech. desc. pickled	0.33-6.35	12-2070	0.33-6.35	18-2070
2F	Cold rolled, heat treated, skin passed	0.33-3.58	12-1524	0.33-3.58	18-1524

2G	Ground	0.30-6.00	12-1600	0.30-4.00	18-1524
2H	Work hardened	0.05-6.00	3-1530	0.30-6.00	18-1530
2J	Brushed or dull polished	0.50-3.00	30-1530	0.30-3.00	400-1530
2K	Satin finish	0.40-4.00	12-1600	0.40-4.00	18-1524
2M	Patterned	0.30-3.50	30-1530	0.30-3.50	400-1524
2R	Cold rolled, bright annealed	0.05-3.50	3-1500	0.25-3.50	18-1500
2W	Profile rolled	0.40-1.50	36-1275	0.40-1.50	400-1250

### Continous hot rolled products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
1C	Hot rolled, heat treated, not descaled	1.90-10.00	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.	1.36-4.50	50-1620	1.36-4.50	50-1620
1G	Ground	1.90-3.00	750-1350	1.90-3.00	750-1350
1H	Hot rolled, temper rolled	1.00-7.00	50-1610		
1M	Patterned	1.90-3.00	750-1350	1.90-3.00	750-1350
1U	Black hot rolled	1.90-10.00	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
1G	Ground			15.00-29.99	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
<b>Typical</b>	<b>0.04</b>		<b>18.1</b>	<b>8.1</b>			
ASME II A SA-240	≤0.07	≤2.00	17.5-19.5	8.0-10.5		≤0.10	
ASTM A240	≤0.08	≤2.00	18.0-20.0	8.0-11.0		≤0.10	
ASTM A666	≤0.08	≤2.00	18.0-20.0	8.0-10.5		≤0.10	
EN 10028-7	≤0.07	≤2.00	17.5-19.5	8.0-10.5		≤0.10	
EN 10088-2	≤0.07	≤2.0	17.5-19.5	8.0-10.5		≤0.10	
EN 10088-3	≤0.07	≤2.00	17.5-19.5	8.0-10.5		≤0.10	
EN 10088-4	≤0.07	≤2.0	17.5-19.5	8.0-10.5		≤0.10	
GOST 5632-72	≤0.12	≤2.0	17.0-19.0	8.0-10.0	≤0.35	≤0.10	
IS 6911	≤0.07	≤2.00	17.5-19.5	8.0-10.5	≤0.70	≤0.10	
IS 6911	≤0.07	≤2.00	17.5-19.5	8.0-10.5	≤0.70	≤0.10	

## Corrosion resistance

Core 304/4301 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. Grade 4301 may suffer from uniform corrosion in mineral acids and hot strong alkaline solutions. More detailed information on corrosion properties of Core 304/4301 can be found in Outokumpu's Corrosion Tables published in the [Outokumpu Corrosion Handbook](#) and on [www.outokumpu.com](http://www.outokumpu.com).

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 304/4301 can tolerate even relatively high chloride concentrations. The presence of corrosion-inhibiting or accelerating compounds like transition metal ions or organic compounds may influence the corrosion behavior of Core 304/4301.

Core 304/4301 is prone to chloride-induced stress corrosion cracking at temperatures over about 50 °C depending on the applied stress and the chloride concentration in the environment. Prior cold deformation of the structure under load increases the risk of stress corrosion cracking.

Core 304/4301 can be used for indoor and outdoor applications in rural areas and urban environments where chloride contamination is low. The best material performance is usually reached with the help of adequate design, correct post-weld treatment, and regular cleaning during use (if applicable).

For more information on corrosion resistance, please refer refer to the Outokumpu Corrosion Handbook or contact our corrosion experts.

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

Pitting Resistance Equivalent (PRE) is calculated using the following formula:  $PRE = \%Cr + 3.3 \times \%Mo + 16 \times \%N$

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 in soft annealed condition at room temperature are given in the table below. Moderate strengths can be reached at elevated temperatures (~550 °C). Temperatures for excessive scaling are close to 850 °C. This grade, along with other austenitic corrosion-resistant steels, exhibits very high ductility and high elongation to fracture. It is not susceptible to brittle fracture in the solution annealed condition.

Due to the high impact toughness and tensile properties at very low temperatures this grade is applicable for cryogenic applications down to -196 °C.

This austenitic grade is also available in the temper rolled condition. Higher product strength can be achieved, when the final cold rolling process is controlled and the material is left in a work hardened condition. Strength classes are given in the standards EN 10088-2 and ASTM A666-03.

Please contact your local Outokumpu sales company for more information.

Cold rolled coil and sheet	R <sub>p0.2</sub> MPa	R <sub>p1.0</sub> MPa	R <sub>m</sub> MPa	Elongation <sup>1)</sup> %	Impact strength J	Rockwell	HB	HV
<b>Typical (thickness 1 mm)</b>	<b>285</b>	<b>315</b>	<b>640</b>	<b>70</b>				
ASME II A SA-240	≥ 205		≥ 515				≤ 201	
ASTM A240	≥ 205		≥ 515			≤ 92HRB	≤ 201	
EN 10028-7	≥ 230	≥ 260	540 - 750	≥ 45				
EN 10088-2	≥ 230	≥ 260	540 - 750	≥ 45				
EN 10088-4	≥ 230	≥ 260	540 - 750	≥ 45				
GOST 5632-72	≥ 230	≥ 260	540 - 670	≥ 45				
IS 6911	≥ 205		≥ 515			≤ 92HRB	≤ 201	
IS 6911	≥ 205		≥ 515			≤ 92HRB	≤ 201	

Hot rolled coil and sheet	R <sub>p0.2</sub> MPa	R <sub>p1.0</sub> MPa	R <sub>m</sub> MPa	Elongation <sup>1)</sup> %	Impact strength J	Rockwell	HB	HV
<b>Typical (thickness 4 mm)</b>	<b>285</b>	<b>340</b>	<b>625</b>	<b>55</b>			<b>175</b>	
ASME II A SA-240	≥ 205		≥ 515				≤ 201	
ASTM A240	≥ 205		≥ 515				≤ 201	
EN 10028-7	≥ 230	≥ 260	520 - 720	≥ 45				
EN 10088-2	≥ 230	≥ 260	520 - 720	≥ 45				
EN 10088-4	≥ 230	≥ 260	520 - 720	≥ 45				
GOST 5632-72	≥ 230	≥ 260	540 - 670	≥ 45				
IS 6911	≥ 205		≥ 515			≤ 92HRB	≤ 201	
IS 6911	≥ 205		≥ 515			≤ 92HRB	≤ 201	

Hot rolled quarto plate	R <sub>p0.2</sub> MPa	R <sub>p1.0</sub> MPa	R <sub>m</sub> MPa	Elongation <sup>1)</sup> %	Impact strength J	Rockwell	HB	HV
<b>Typical (thickness 15 mm)</b>	<b>270</b>	<b>300</b>	<b>600</b>	<b>55</b>				
ASME II A SA-240	≥ 205		≥ 515			≤ 92HRB	≤ 201	
ASTM A240	≥ 205		≥ 515			≤ 92HRB	≤ 201	
EN 10028-7	≥ 210	≥ 250	520 - 720	≥ 45				
EN 10088-2	≥ 210	≥ 250	520 - 720	≥ 45				
EN 10088-4	≥ 210	≥ 250	520 - 720	≥ 45				
IS 6911	≥ 205		≥ 515			≤ 92HRB	≤ 201	

IS 6911	≥ 205	≥ 515	≤ 92HRB	≤ 201
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Wire rod	R <sub>p0.2</sub> MPa	R <sub>p1.0</sub> MPa	R <sub>m</sub> MPa	Elongation <sup>1)</sup> %	Impact strength J	Rockwell	HB	HV
<b>Typical</b>	<b>290</b>	<b>330</b>	<b>600</b>	<b>55</b>				

<sup>1)</sup>Elongation according to EN standard:

A<sub>80</sub> for thickness < 3 mm.

A for thickness ≥ 3 mm.

Elongation according to ASTM standard A<sub>2-</sub> or A<sub>50</sub>.

## Physical properties

Physical properties according to EN 10088-1 are given in the table below.

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

## Fabrication

### Cold forming

Core 304/4301 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 accentuated 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, forging should be annealed at 1050 °C and rapidly cooled in air or water after hot forming operations.

### Machining

Due to their high toughness and work hardening behavior austenitic steels are more difficult to machine than carbon steels but are still comparatively easier than more highly alloyed stainless steel grades. It requires higher cutting forces than carbon steels, shows resistance to chip breaking, and has a high tendency to built-up edge formation. The best machining results are obtained by using high-power equipment, sharp tooling, and a rigid set-up.

Better machinability performance is achieved using Prodec versions, which have been modified for improved machinability. Prodec is available as hot rolled plate and bar in 4301, 4307, 4401, 4404, 4436 and 4432.

### Welding

Austenitic Core 304/4301 grade 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 304/4301 have 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. In thicker sections, the low-carbon grade 4307 is preferred, and to ensure that the weld metal properties (e.g. strength, corrosion resistance) are equivalent to those of the parent metal, matching or slightly over-alloyed fillers should preferably be used. 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.

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
ASME SA-240M Code Sect. II. Part A	TYPE 304 / UNS S30400
ASTM A240/A240M	TYPE 304 / UNS S30400
ASTM A666	TYPE 304 / UNS S30400
EN 10028-7, PED 2014/68/EU	1.4301
EN 10088-2	1.4301
EN 10088-3	1.4301
EN 10088-4	1.4301
GOST 5632-72	12X18H9
IS 6911, AMENDMENT NO. 2	ISS 304; ISS 304 S1

## Contacts & Enquiries

[Contact your nearest sales office](#)

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