outokumpu
high performance stainless steel

Core 301/4310

EN 1.4310, ASTM TYPE 301 / UNS S30100

General characteristics

Core 301/4310 has a lower chromium and nickel alternative to Core 304/4301 with high work hardening capacity. It is a good choice for applications subjected to high mechanical loading. Core 301/4310 is an austenitic CrNi stainless steel with high carbon and relatively low nickel content. It shows a high degree of work hardening on mechanical deformation.

Core 301/4310 is used in applications where corrosion resistance and a combination of high mechanical strength and good formability are needed. Due to its strong tendency to work hardening, Core 301/4310 can absorb an increased amount of energy during deformation. It can be delivered in temper rolled condition with different strength levels.

Typical applications

- Springs
- Press plates
- Conveyor chains
- Mixer blades
- Sinks

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	0.33-6.35	12-1550	0.33-6.35	18-1550
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	0.30-6.35	30-1590	0.30-6.35	400-1590
2E	Cold rolled, heat treated, mech. desc. pickled	0.30-6.00	12-1530	0.33-6.00	18-1530
2F	Cold rolled, heat treated, skin passed	0.33-3.58	12-1524	0.33-3.58	18-1524
2G	Ground	0.30-3.58	12-1530	0.30-3.58	18-1530
2H	Work hardened	0.05-22.00	3-1500	0.30-5.00	18-1500
2J	Brushed or dull polished	0.30-3.00	30-1500	0.30-3.00	600-1530
2K	Satin finish	0.53-3.58	12-1524	0.53-3.58	18-1524
2R	Cold rolled, bright annealed	0.05-3.50	3-1500	0.33-3.50	18-1500

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	2.54-9.52	50-1610	2.54-9.52	50-1610
1E	Hot rolled, heat treated, mech. desc.	1.75-4.50	50-1610	1.75-4.50	50-1610
1G	Ground	2.00-3.00	750-1350	2.00-3.00	750-1350
1U	Black hot rolled	2.00-10.00	50-1550		

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	**0.10**		**17.0**	**7.0**			
ASME II A SA-240	≤0.15	≤2.00	16.0-18.0	6.0-8.0		≤0.10	
ASME II A SA-240	≤0.03	≤2.00	16.0-18.0	6.0-8.0		≤0.20	
ASTM A240	≤0.15	≤2.00	16.0-18.0	6.0-8.0		≤0.10	
ASTM A240	≤0.03	≤2.00	16.0-18.0	6.0-8.0		≤0.20	
ASTM A666	≤0.15	≤2.00	16.0-18.0	6.0-8.0		≤0.10	
EN 10088-2	0.05-0.15	≤2.0	16.0-19.0	6.0-9.5	≤0.80	≤0.10	
EN 10088-3	0.05-0.15	≤2.00	16.0-19.0	6.0-9.5	≤0.80	≤0.10	
IS 6911	≤0.15	≤2.00	16.0-18.0	6.0-8.0	≤0.70	≤0.10	
IS 6911	≤0.03	≤2.00	16.0-18.0	6.0-8.0	≤0.70	≤0.20	

Corrosion resistance

Outokumpu grade Core 301/4310 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 301/4310 may suffer from uniform corrosion in mineral acids and hot strong alkaline solutions.

Due to its high carbon content, this product is easily sensitized for intergranular corrosion during heat treatment or welding.

In aqueous solutions containing halogenides like 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 periods of time, for instance when cooking food in stainless steel dishes, Core 301/4310 can even tolerate relatively high chloride concentrations. Due to its relatively low chromium content, the resistance of Core 301/4310 against pitting and crevice corrosion is slightly decreased compared to the basic austenitic CrNi Core 304/4301 and Core 304L/4307. The presence of corrosion inhibiting or accelerating compounds e.g. transition metal ions or organic compounds may influence the corrosion behavior of Core 301/4310.

Core 301/4310 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 301/4310 can be used for indoor and outdoor applications in rural areas and urban environments where chloride contamination is low. The best material performance is typically achieved with the help of adequate design, correct post-weld treatment, and regular cleaning during use (if applicable).

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

Pitting corrosion resistance		Crevice corrosion resistance
PRE	CPT	CCT
17	<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

Typical mechanical properties in annealed condition at room temperature is shown below.

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)	**300**	**325**	**770**	**65**				
ASME II A SA-240	≥ 205		≥ 515				≤ 201	
ASME II A SA-240	≥ 220		≥ 550					
ASTM A240	≥ 205		≥ 515			≤ 95HRB	≤ 201	
ASTM A240	≥ 220		≥ 550					
EN 10088-2	≥ 250	≥ 280	600 - 950	≥ 40				
IS 6911	≥ 205		≥ 515			≤ 95HRB	≤ 217	
IS 6911	≥ 220		≥ 550			≤ 100HRB	≤ 241	

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)	**330**	**365**	**750**	**50**			**90**	
ASME II A SA-240	≥ 205		≥ 515				≤ 201	
ASME II A SA-240	≥ 220		≥ 550					
ASTM A240	≥ 205		≥ 515				≤ 201	
ASTM A240	≥ 220		≥ 550					
IS 6911	≥ 205		≥ 515			≤ 95HRB	≤ 217	
IS 6911	≥ 220		≥ 550			≤ 100HRB	≤ 241	

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)	**285**	**315**	**785**					
ASME II A SA-240	≥ 205		≥ 515				≤ 201	
ASME II A SA-240	≥ 220		≥ 550					
ASTM A240	≥ 205		≥ 515				≤ 201	
ASTM A240	≥ 220		≥ 550					
IS 6911	≥ 205		≥ 515			≤ 95HRB	≤ 217	
IS 6911	≥ 220		≥ 550			≤ 100HRB	≤ 241	

Wire rod	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Elongation[1] %	Impact strength J	Rockwell	HB	HV
Typical	**300**	**330**	**800**	**50**				

[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

Data according to EN 10088 is shown in the table below.

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	18,0	15	500	0.73	No

Fabrication

Welding

As an austenitic stainless steel, Core 301/4310 has good 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 301/4310 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. In thicker section, low carbon containing grades are recommended. To ensure that the weld metal properties (such as strength and corrosion resistance) are equivalent to those of the parent metal, matching or slightly over-alloyed fillers should preferably be used. The recommended welding metal is 19 9 L. The Core 301/4310 has fairly high carbon content so chromium carbides may precipitate in the HAZ, resulting in increased risk of intergranular corrosion.

Core 301/4310 in the cold stretched condition can be welded in the same way as material in the annealed condition. As the additional strength obtained by temper rolling is lost within the weldment, the strength, including fatigue strength, is also reduced. The use of high heat input may also reduce the strength in the HAZ. Since the strength is reduced in the weld area, the location of the welds must be carefully considered at the design stage and the welds must be placed, if possible, in less stressed areas.

Post-weld heat treatment is generally not required. In special cases with high risks 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

Standard	Designation
ASME SA-240M Code Sect. II. Part A	TYPE 301L / UNS S30103; TYPE 301L / UNS S30103
ASTM A240/A240M	TYPE 301L / UNS S30103; TYPE 301L / UNS S30103
ASTM A666	TYPE 301L / UNS S30103
EN 10088-2	1.4310
EN 10088-3	1.4310
IS 6911, AMENDMENT NO. 2	ISS 301; ISS 301L

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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