outokumpu
high performance stainless steel

Forta 316L/4404

EN 1.4404, ASTM TYPE 316L / UNS S31603

General characteristics

A low-carbon, molybdenum-alloyed alternative to Supra 316/4401 that is widely used for various applications with higher than average corrosion resistance requirements. Forta 316L/4404 is strengthened with temper rolling for applications that require specific strength as well as improved weldability and intergranular corrosion resistance.

Typical applications

- Chemical tanks and tubing
- Pulp and paper process equipment

Products & dimensions

Cold rolled products, available dimensions (mm)

		Coil / Strip		Plate / Sheet	
Surface finish		Thickness	Width	Thickness	Width
2H	Work hardened	0.05-6.00	3-1530	0.25-6.00	18-1530

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**		**17.2**	**10.1**	**2.1**		
ASME II A SA-240	≤0.030	≤2.00	16.0-18.0	10.0-14.0	2.00-3.00	≤0.10	
ASTM A240	≤0.030	≤2.00	16.0-18.0	10.0-14.0	2.00-3.00	≤0.10	
ASTM A666	≤0.030	≤2.00	16.0-18.0	10.0-14.0	2.00-3.00	≤0.10	
EN 10028-7	≤0.030	≤2.00	16.5-18.5	10.0-13.0	2.00-2.50	≤0.10	
EN 10088-2	≤0.030	≤2.0	16.5-18.5	10.0-13.0	2.0-2.5	≤0.10	

EN 10088-3	≤0.030	≤2.00	16.5-18.5	10.0-13.0	2.0-2.5	≤0.10	
EN 10088-4	≤0.030	≤2.0	16.5-18.5	10.0-13.0	2.0-2.5	≤0.10	
IS 6911	≤0.030	≤2.00	16.0-18.0	10.0-14.0	2.00-3.00	≤0.10	

Corrosion resistance

Pitting corrosion resistance		Crevice corrosion resistance
PRE	CPT	CCT
24	20±2	<0

PRE Pitting Resistant Equivalent calculated using the formula: PRE = %Cr + 3.3 x %Mo + 16 x %N
CPT Corrosion Pitting Temperature as measured in the Avesta Cell (ASTM G 150), in a 1M NaCl solution (35,000 ppm or mg/l chloride ions).
CCT Critical Crevice Corrosion Temperature is the critical crevice corrosion temperature which 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.

Cold rolled coil and sheet	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Impact strength J	Rockwell	HB	HV
Typical (thickness 1 mm)	**300**	**325**	**625**				
ASME II A SA-240	≥ 170		≥ 485			≤ 217	
ASTM A240	≥ 170		≥ 485		≤ 95HRB	≤ 217	
EN 10028-7	≥ 240	≥ 270	530 - 680				
EN 10088-2	≥ 240	≥ 270	530 - 680				
EN 10088-4	≥ 240	≥ 270	530 - 680				
IS 6911	≥ 170		≥ 485		≤ 95HRB	≤ 217	

Hot rolled coil and sheet	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Impact strength J	Rockwell	HB	HV
Typical (thickness 4 mm)	**300**	**350**	**600**			**170**	
ASME II A SA-240	≥ 170		≥ 485			≤ 217	
ASTM A240	≥ 170		≥ 485			≤ 217	
EN 10028-7	≥ 240	≥ 270	530 - 680				
EN 10088-2	≥ 240	≥ 270	530 - 680				
EN 10088-4	≥ 240	≥ 270	530 - 680				
IS 6911	≥ 170		≥ 485		≤ 95HRB	≤ 217	

Hot rolled quarto plate	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Impact strength J	Rockwell	HB	HV
Typical (thickness 15 mm)	**260**	**300**	**570**				
ASME II A SA-240	≥ 170		≥ 485		≤ 95HRB	≤ 217	
ASTM A240	≥ 170		≥ 485		≤ 95HRB	≤ 217	
EN 10028-7	≥ 220	≥ 260	520 - 670				
EN 10088-2	≥ 220	≥ 260	520 - 670				
EN 10088-4	≥ 220	≥ 260	520 - 670				

IS 6911	≥ 170		≥ 485		≤ 95HRB	≤ 217	

Wire rod	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Impact strength J	Rockwell	HB	HV
Typical	**220**	**260**	**530**				

[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 according to EN 10088 are shown 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
8.0	200	16,0	15	500	0.75	No

Fabrication

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 316L / UNS S31603
ASTM A240/A240M	TYPE 316L / UNS S31603
ASTM A666	TYPE 316L / UNS S31603
EN 10028-7, PED 2014/68/EU	1.4404
EN 10088-2	1.4404
EN 10088-3	1.4404
EN 10088-4	1.4404
IS 6911, AMENDMENT NO. 2	ISS 316 L

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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