outokumpu
high performance stainless steel

Forta SDX 2507

EN 1.4410, ASTM UNS S32750

General characteristics

Forta SDX 2507 is a super duplex product with higher corrosion resistance and mechanical strength than Forta DX 2205. Often used in extremely corrosive environments such as desalination, chemical, or offshore subsea applications.

Typical applications

- Desalination plants
- Industrial piping
- Scrubbers
- Tubes for oil and gas applications
- Deep-sea pipelines
- Flanges and valves

Products & dimensions

Cold rolled products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
2E	Cold rolled, heat treated, mech. desc. pickled	0.50-6.00	36-1650	0.50-6.00	300-1570

Continous hot rolled products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
1D	Hot rolled, heat treated, pickled	5.50-8.00	96-1650	5.50-8.00	300-1570

Quarto plate products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
1D	Hot rolled, heat treated, pickled			6.00-50.00	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**		**25.0**	**7.0**	**4.0**	**0.27**	
ASME II A SA-240	≤0.030	≤1.20	24.0-26.0	6.00-8.00	3.00-5.00	0.24-0.32	
ASTM A240	≤0.030	≤1.20	24.0-26.0	6.0-8.0	3.0-5.0	0.24-0.32	
EN 10028-7	≤0.030	≤2.00	24.00-26.00	6.00-8.00	3.00-4.50	0.20-0.35	
EN 10088-2	≤0.030	≤2.00	24.0-26.0	6.0-8.0	3.0-4.5	0.24-0.35	
EN 10088-3	≤0.030	≤2.00	24.0-26.0	6.0-8.0	3.0-4.5	0.24-0.35	
EN 10088-4	≤0.030	≤2.00	24.0-26.0	6.0-8.0	3.0-4.5	0.24-0.35	
IS 6911	≤0.030	≤1.20	24.0-26.0	6.0-8.0	3.0-5.0	0.24-0.32	

Corrosion resistance

Uniform corrosion

The alloying elements chromium and molybdenum give Forta SDX 2507 excellent resistance to uniform corrosion. This type of corrosion occurs in acids or in hot alkaline solutions. For guidance on material selection in a large number of environments capable of causing uniform corrosion, consult the tables and iso-corrosion diagrams in the Outokumpu Corrosion Handbook.

Pitting and crevice corrosion

Chloride ions in a neutral or acidic environment facilitate local breakdown of the passive layer. As a result, pitting and crevice corrosion can propagate at a high rate, causing corrosion failure in a short time. Since the attack is small and may be covered by corrosion products or hidden in a crevice, it often remains undiscovered until perforation or leakage occurs. Resistance to pitting corrosion is determined mainly by the content of chromium, molybdenum, and nitrogen in the stainless steel. Forta SDX 2507 has good resistance to pitting and crevice corrosion due to the chromium and nitrogen content.

Stress corrosion cracking

Forta SDX 2507 has excellent resistance to stress corrosion cracking, a form of corrosion that can occur in chloride-containing environments at elevated temperatures.

Another type of stress corrosion cracking can be induced by hydrogen sulfide. Good resistance to this type of stress corrosion cracking is important in the oil and gas industry. Forta SDX 2507 is approved according to NACE MR0175/ISO 1515 for use in H2S-containing environments in oil and gas production.

Pitting corrosion resistance		Crevice corrosion resistance
PRE	**CPT**	**CCT**
43	84±2	35

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 duplex stainless steels have much higher mechanical strength compared to standard stainless steels. If the high strength of the duplex grades can be utilized, downgauging can be done in many applications, leading to cost-efficient solutions. The allowable design values may vary between product forms. The appropriate values are given in the relevant specifications.

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)	**730**	**790**	**940**	**40**				
ASME II A SA-240	≥ 550		≥ 795				≤ 310	
ASTM A240	≥ 550		≥ 795			≤ 32HRC	≤ 310	
EN 10028-7	≥ 550		750 - 1000	≥ 20				
EN 10088-2	≥ 550		750 - 1000	≥ 20				
EN 10088-4	≥ 550		750 - 1000	≥ 20				
IS 6911	≥ 550		≥ 795			≤ 32HRC	≤ 310	

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)	**700**	**785**	**905**	**30**			**270**	
ASME II A SA-240	≥ 550		≥ 795				≤ 310	
ASTM A240	≥ 550		≥ 795				≤ 310	
EN 10028-7	≥ 550		750 - 1000	≥ 20				
EN 10088-2	≥ 550		750 - 1000	≥ 20				
EN 10088-4	≥ 550		750 - 1000	≥ 20				
IS 6911	≥ 550		≥ 795			≤ 32HRC	≤ 310	

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)	**580**		**830**	**35**			**250**	
ASME II A SA-240	≥ 550		≥ 795			≤ 32HRC	≤ 310	
ASTM A240	≥ 550		≥ 795			≤ 32HRC	≤ 310	
EN 10028-7	≥ 530		730 - 930	≥ 20				
EN 10088-2	≥ 530		730 - 930	≥ 20				

EN 10088-4	≥ 530		730 - 930	≥ 20				
IS 6911	≥ 550		≥ 795			≤ 32HRC	≤ 310	

[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

The physical properties at room temperature are shown in the table below. Data according to EN 10088 or EN 10095.

Density kg/dm³	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
7.8	200	13	15	500	0.8	Yes

Fabrication

Duplex stainless steel applicable to all forming processes available for stainless steel. The high proof strength compared to austenitic and ferritics stainless steel can impose some differences in forming behavior depending on the chosen forming technique, such as an increased tendency to springback. This point is particularly relevant to forming of any high strength steel. If the forming process is not already decided, it is possible to choose the most suitable one for duplex grades. Moreover, an excellent interplay between high proof strength, work hardening rate, and elongation mean that the duplex grades are particularly well suited to lightweight and cost-efficient applications with complex shapes. The impact of the high strength varies for different forming techniques. Common to all is that the estimated forming forces will be higher than for the corresponding austenitic and ferritic stainless steel grades. This effect will usually be lower than expected from just the increase in strength since the choice of duplex stainless steel is often associated with downgauging. It is important to consider that duplex stainless steel may also place higher demands on the for the tool materials and lubricants. Downgauging should also be considered in this case.

Machining

Duplex steels are generally more demanding to machine than conventional austenitic stainless steel such as Supra 316L/4404, due to the higher hardness. More information can be found in the machining guidelines which are available for each duplex grade.
Machining guidelines Forta SDX 2507.

Welding

Forta SDX 2507 has good weldability and can be welded using most of the common methods used for stainless steel:
- Shielded metal arc welding (SMAW)
- Gas tungsten arc welding TIG(GTAW)
- Gas metal arc welding MIG (GMAW)
- Flux-cored arc welding (FCW)
- Plasma arc welding (PAW)
- Submerged arc welding (SAW)
- Laser welding
- Resistance welding
- High frequence welding

The following general instructions should be followed:
- The material should be welded without preheating.
- The material should be allowed to cool between passes, and the interpass temperature should not exceed 100 °C
- To obtain good weld metal properties in the as-welded condition, filler material should be used.
- The recommended arc energy should be kept within certain limits to achieve a good balance between ferrite and austenite in the weld. The heat input should be below 1.5 KJ/mm
- Post-weld annealing after welding with filler is not necessary.
- To ensure optimum pitting resistance when using GTAW and PAW methods, the addition of nitrogen to the shielding/purging gas is recommended.

Forta SDX 2507 is more prone to inter-metallic precipitation in the weld metal. If welding is done from only one side and the root side will be exposed to corrosive media, it is important to make the root thick and following beads thin with low heat input. This minimizes the amount of detrimental sigma phase in the root. For SAW, the wire should not exceed Ø2.4 mm to facilitate low heat input welding.

For more information see Outokumpu Welding Handbook.

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

Standards & approvals

Outokumpu produces and certifies materials to most international and national standards. Work is continuously on-going to get the different grades approved for relevant standards.

Standard	Designation
ASME SA-240M Code Sect. II. Part A	UNS S32750
ASTM A240/A240M	UNS S32750
EN 10028-7, PED 2014/68/EU	1.4410
EN 10088-2	1.4410
EN 10088-3	1.4410
EN 10088-4	1.4410
IS 6911, AMENDMENT NO. 2	ISS 2507

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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