outokumpu
high performance stainless steel

Forta FDX 27

ASTM FDX 27 / UNS S82031

General characteristics

Ferritic-austenitic stainless steels also referred to as duplex stainless steels, combine many of the beneficial properties of ferritic and austenitic steels. Due to the relatively high content of chromium and nitrogen, these steels offer good resistance to localized and uniform corrosion.
The new FDX product family exhibits a unique combination of high strength and substantially improved formability utilizing Transformation Induced Plasticity (TRIP). Characteristic properties are:

- Increased formability compared to other duplex grades
- High mechanical strength
- Good resistance to uniform corrosion
- Good resistance to pitting and crevice corrosion
- High resistance to stress corrosion cracking and corrosion fatigue
- Good abrasion and erosion resistance
- Good fatigue resistance
- High energy absorption
- Low thermal expansion
- Good weldability

Typical applications

The FDX family provides a totally new stainless steel solution for applications where the formability of other duplex grades is not sufficient or limits the design efficiency. Examples of potential applications are given below:

- Plate heat exchangers
- Flexible pipes
- Pump components
- Components for automotive industry
- Components for structural design
- Domestic heater piping
- Central heating piping

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	0.40-5.00	36-1500	0.40-5.00	36-1500
2H	Work hardened	0.40-3.50	36-1500		

Chemical composition

	C	Mn	Cr	Ni	Mo	N	Other
Typical							
ASME II A SA-240	≤0.05	≤2.50	19.0-22.0	2.0-4.0	0.60-1.40	0.14-0.24	
ASTM A240	≤0.05	≤2.50	19.0-22.0	2.0-4.0	0.60-1.40	0.14-0.24	

Corrosion resistance

The duplex grades provide in general a wide range of corrosion resistance in various environments. However, as the increased formability of FDX 27™ is based on the TRIP-effect (Transformation Induced Plasticity), where the metastable austenite transforms partly into martensite during cold-forming or mechanical treatments like grinding or shot blasting, there is a risk that the corrosion resistance decreases somewhat in those affected areas. All investigations and data presented in this data sheet are from un-deformed flat specimens.

Pitting corrosion resistance		Crevice corrosion resistance
PRE	CPT	CCT
0	27±3	

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

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)	**650**		**850**					
ASME II A SA-240	≥ 400		≥ 650			≤ 31HRC	≤ 290	
ASTM A240	≥ 500		≥ 650			≤ 31HRC	≤ 290	

[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

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
7.7	205	12,5	14,5	500	0.8	Yes

Fabrication

Cold forming

The high proof strength of duplex stainless steel compared to austenitic and ferritic stainless steel can impose some differences in forming behavior depending on chosen forming technique. The impact of the high strength varies for different forming techniques.

Common for 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 down gauging.

FDX 27™ have excellent formability properties in comparison to other duplex stainless steels such as LDX 2101® and 2304 and close to standard austenitic stainless steels such as 4307 and 4404. The TRIP effect offers a balanced work hardening rate resulting in an enhanced uniform elongation and higher work hardening ratio at large (plastic) deformations in comparison to other duplex grades. These remarkable mechanical properties make the FDX grades more suitable for manufacturing of components with stretch forming as the primary forming operation. As for most of the duplex stainless steels, the Lankford values (r-values) are less than 1.0 in all directions but always larger than 0.4.

Figure 1 shows the elongation versus the proof strength for different types of stainless steels, illustrating that the FDX grades form a type of group with a new and unique combination of properties.

Figure 1

The key advantage of FDX 27™ compared to other duplex grades is that they are more adaptable to various forming processes since they have far better formability. For example, components to be formed predominantly by deep drawing can almost be designed as those made in standard austenitic stainless steels with good results. Moreover, physical try-outs verify that the FDX grades are suitable for forming intensive component such as heat exchanger plates. Outokumpu, Avesta Research Centre can support customers in detailed computer analyses of the impact on the forming process of the FDX grades.

Welding

Duplex steels including FDX 27™ generally have good weldability and can be welded using most of the welding methods used for austenitic stainless steels.

Standards & approvals

Standard	Designation
ASME SA-240M Code Sect. II. Part A	UNS S82031
ASTM A240/A240M	UNS S82031

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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