DUPLEX
Stainless Steel Plate

Corrosion Resistance Plus High Strength

Sandmeyer Steel has an extensive inventory of Duplex LDX 2101®, 2304, 2205 and 2507 plate products available to satisfy your requirements.

ALLOY	TYPICAL COMP							YIELD	TENSILE	ELONG
	EN	ASTM	C	CR	Ni	Mo	N	ksi	ksi	%
LDX 2101®	1.4162	S32101	.03	21.5	1.5	0.3	.22	65	94	30
2304	1.4362	S32304	.02	23.0	4.8	0.3	.10	58	87	25
2205	1.4462	S31803/ S32205	.02	22.0	5.7	3.1	.17	65	90	25
2507	1.4410	S32750	.02	25.0	7.0	4.0	.27	80	116	15

General Characteristics

Duplex Stainless Steels combine many of the beneficial properties of ferritic and austenitic materials to provide both high strength and good corrosion resistance. Due to their high chromium, molybdenum and nitrogen contents and duplex structure, these steels offer many benefits in comparison to 300 series austenitic grades:

- High Strength - Approximately twice the level of austenitics
- Good resistance to pitting and crevice corrosion
- Excellent resistance to stress-corrosion cracking
- Good erosion and fatigue resistance
- Good weldability and increased heat transfer
- More stable pricing due to lower Ni levels than austenitic stainless grades

Applications

Due to their high strength and corrosion resistance properties, Duplex Stainless Steels are used in a variety of applications such as:

- Pressure vessels, reactor tanks and heat exchangers
- Desalination plants and seawater systems
- Water transmission pipes
- Rotors, impellers and shafts in industrial equipment
- Digesters, storage and clarifier tanks, stock washers and other equipment for the pulp and paper industry
- Absorber towers, FGD systems for air pollution control
- Phosphoric acid production
- Food, oil and gas, mining and architectural applications
- Biofuels plants

Value Added Processing

The Value Added Plate Processing capabilities that have serviced thousands of our satisfied customers for over 60 years are also available for your Plate Product requirements in Duplex Stainless Steels. With over 100 pieces of in-house plate processing equipment, Sandmeyer can provide you with nearly any shape or configuration required. From plasma cut edge beveling to band saw cutting to abrasive waterjet cutting to *Machincut* rings and discs to rolled and code-welded rings, Sandmeyer's value added plate processing capabilities are second to none.

Visit *www.SandmeyerSteel.com* for a complete review of the Value Added Plate Processing we can do for you, as well as the most up-to-date Duplex Stainless Steel stock list.

STOCK SIZES	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	4	5	6
LDX 2101®	●	●	●	●	●	●	●		●		●		●		●	●									
2304	●	●	●	●	●	●	●		●																
2205	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2507	●	●	●	●	●	●	●		●		●		●	●	●	●	●	●	●	●					

For more information please visit our website: http://bit.ly/duplexsteel

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Providing Solutions, With Materials and Value Added Products, for Process Industries

DUP 01/2012 5M

Design Stress Allowance

One of the advantages of nitrogen-enriched duplex stainless steels is their higher strength levels in comparison to conventional austenitic stainless steels. This allows for construction of units in thinner cross-sections. This weight savings can dramatically reduce the material and fabrication cost of a vessel.

ASME Boiler & Pressure Vessel Code, Section VIII, Division 1, Allowable Stress Values, ksi

Alloy	200 °F	300 °F	400 °F	500 °F	600 °F
LDX 2101®	26.9	25.6	24.7	24.7	24.7
304L	20.0	18.9	18.3	17.5	16.6
316L	20.0	20.0	19.3	18	17
2205	25.7	24.8	23.9	23.3	23.1
2304	24.0	22.5	21.7	21.3	21
2507	33.0	31.2	30.1	29.6	29.4

Corrosion Properties

Duplex stainless steels provide a wide range of corrosion resistance across a broad spectrum of applications. Below is a brief description of their resistance in various process environments.

General Corrosion

General corrosion is characterized as a uniform attack on a surface in contact with a corrosive medium. The corrosion resistance is considered good if the corrosion rate is less than 0.1 mm/yr. Because of their high chromium content, duplex stainless steels offer excellent corrosion resistance in many process environments. LDX 2101 has, in most cases, better resistance than 304L and in some applications resistance comparable to 316L. 2304, in most cases, is equivalent to 316L., while 2205 and 2507 exhibit even better resistance than most conventional austenitic stainless steels.

Sulfuric Acid

The isocorrosion diagram for sulfuric acid is shown to the right. In sulfuric acid contaminated by chloride ions, 2205 shows much better resistance than 316L and has similar resistance to 904L.

Hydrochloric Acid

304L and 316L have very limited use in hydrochloric acid due to the risk of general and localized corrosion. 2507, and to some extent 2205, can be used in dilute hydrochloric acid.

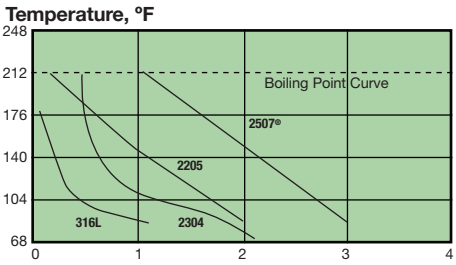
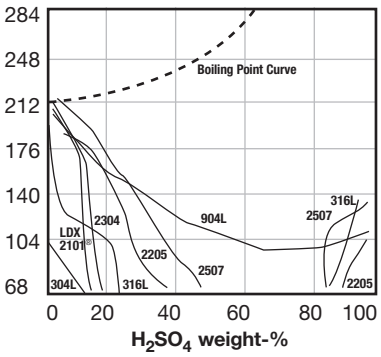


Fig. 4. Isocorrosion curves 0.1 mm/year, in hydrochloric acid.

Isocorosion curves, 0.1 mm/year, in sulfuric acid



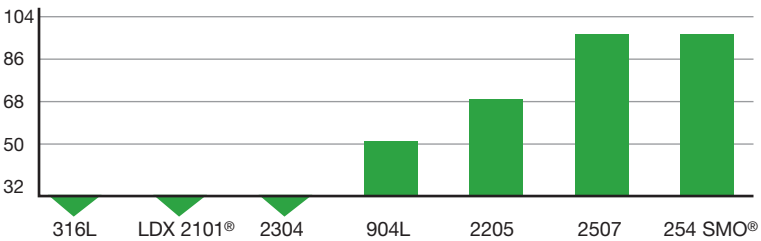
Nitric Acid

In strongly oxidizing acids, e.g. nitric acid, non-molybdenum alloys are often more resistant. LDX 2101 and 2304 are good alternatives because of their high chromium and low molybdenum content.

Crevice Corrosion Resistance

The Critical Crevice Corrosion Temperature (CCCT) test is often used to compare the crevice corrosion resistance of various alloys.

CCT, °F



Typical critical crevice corrosion temperature according to ASTM G48 Method F in 6%$FeCl_3$ + 1%HCl

Chloride Pitting Resistance

The pitting resistance of stainless steel can be related directly to alloy composition, where chromium, molybdenum and nitrogen are a weight %. The Pitting Resistance Equivalent Number (PREN) uses the following formula – the higher the number the better the pitting resistance –

PREN = %Cr + 3.3Mo + 30N

PREN values for different austenitic and duplex grades

Isocorosion curves	PRE
304L	18
316L	24
LDX 2101®	26
2304	26
904L	34
2205	35
254 SMO®	43
2507	43

Stress-Corrosion Cracking Resistance

Austenitic stainless steels can be attacked by chloride stress-corrosion cracking at elevated temperatures. Duplex stainless steels are less susceptible to this form of corrosion. The results of a drop evaporation test indicate that duplex stainless steels are superior to conventional austenitic stainless steels.

Applied stress at rupture in % of $R_{p0.2}$ at 392°F

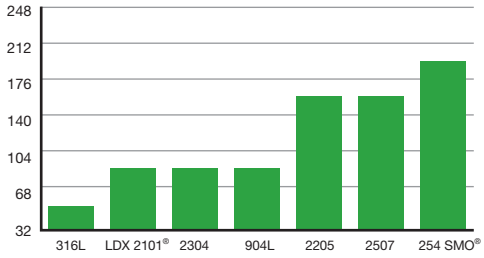


Fig. 7. Typical threshold stresses determined using the drop evaporation test.

NOTE

This technical data and information represents our best knowledge at the time of printing. However, it may be subject to some slight variations due to our ongoing research program on corrosion resistant grades.

We, therefore, suggest that information be verified at time of inquiry or order. Furthermore, in service, real conditions are specific for each application. The data presented here is only for the purpose of description and may only be considered as guarantees when our Company has given written formal approval.

SANDMEYER STEEL COMPANY