

# Specification Sheet: Alloy LDX 2101<sup>®</sup>

## (UNS S32101) EN 1.4162

Low nickel, lean duplex stainless steel possessing both superior strength and chloride stress-corrosion cracking resistance when compared to 300 series stainless steels

LDX 2101 is a low-nickel, nitrogen enhanced lean duplex stainless steel developed for general-purpose use. The austenitic-ferritic (duplex) structure of the alloy is balanced to approximately equal amounts of ferrite and austenite in the solution-annealed condition.

The high chromium and nitrogen content of LDX 2101, combined with an addition of molybdenum, provide very good resistance to localized and uniform corrosion. The duplex microstructure contributes to the alloys high strength and resistance to chloride stress-corrosion cracking. LDX 2101 possesses both superior strength and greater chloride stress-corrosion cracking resistance than conventional 300 series stainless steels.

The corrosion resistance of LDX 2101 is generally good making it suitable for use in a wide variety of applications. In most environments, it is superior to 304L stainless steel and comparable to the molybdenum containing 316L stainless steel.

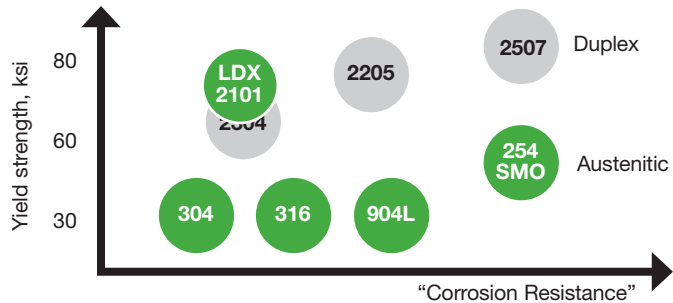
The enhanced mechanical strength of LDX 2101 is far superior to conventional 300 series stainless steels enabling it to be used in thinner cross-sections which can provide significant cost savings to the end user.

LDX 2101 exhibits good abrasion and erosion resistance and can be fabricated using standard shop practices developed for duplex stainless steels.

### Applications

- Air Pollution Control
  - External absorber and outlet duct reinforcements
- Biofuels
  - Biodiesel and Ethanol plants and tanks
- Chemical Process Equipment
  - Pressure vessels, heat exchangers, tanks, piping systems and tankers
- Food and Beverage Process Equipment
  - Palm oil and wine storage tanks
- Infrastructure
  - Bridges, flood gates, sluice gates
- Pulp and Paper
  - Hydrogen peroxide bleaching reactors, white liquor storage tanks, digesters, washers, paper machine parts
- Seawater Treatment
  - Desalination system chambers and evaporators
- Water and Wastewater Treatment

### Properties of LDX 2101



### Standards

ASTM ..... A 240

ASME ..... SA 240

### Chemical Analysis

#### Typical Values (Weight %)

Cr	Ni	Mn	Mo	N
21.0 min. - 22.0 max.	1.35 min. - 1.70 max.	4.00 min. - 6.00 max.	0.10 min. - 0.80 max.	0.20 min. - 0.25 max.

C	Si	P	Cu	S	Fe
0.040 max.	1.00 max.	0.040 max.	0.10 min. - 0.80 max.	0.030 max.	Balance*

\*Alloy predominates remaining composition. Other elements may be present only in minimal quantities.

### Physical Properties

		Temperature, °F			
		68	200	400	600
Density	lb/in <sup>3</sup>	0.28			
Modules of Elasticity	x 10 <sup>6</sup> psi	29	28	27	26
Poissons Ratio		0.3			
Linear Expansion	x10 <sup>-6</sup> in/in/°F	—	7.2	7.5	7.5
Thermal Conductivity	Btu/ft/h °F	8.7	9.3	9.8	10.4
Thermal Capacity	J/kg °F	500	530	560	590
Electric Resistivity	micro-ohms-meter	0.80	0.85	0.90	1.00

### Mechanical Properties

		Minimum values (.625" Plate)	Typical values (.625" Plate)
0.2% Offset Yield Strength	ksi	65	69
Tensile Strength	ksi	94	101
Elongation	%	30	38
Hardness (Brinell)	HB	290 (max)	225



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## 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 with 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

## Corrosion Properties

The 300 series stainless steels are used extensively in numerous process industries due to their overall general corrosion resistance. The corrosion resistance of LDX 2101 is generally better than 304L and comparable to 316L making it suitable for use in a wide variety of industries and applications.

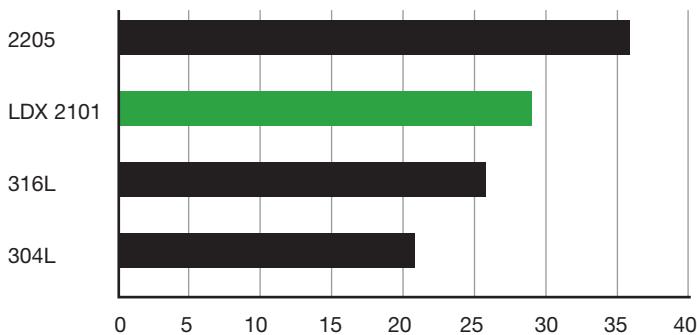
## Chloride Pitting Resistance

The pitting resistance of an austenitic 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 to measure an alloy's relative pitting resistance - the higher the number, the better the pitting resistance.

$$\text{PREN} = \%Cr + 3.3Mo + 30N$$

The following chart compares the PREN for LDX 2101 with other common stainless steels.

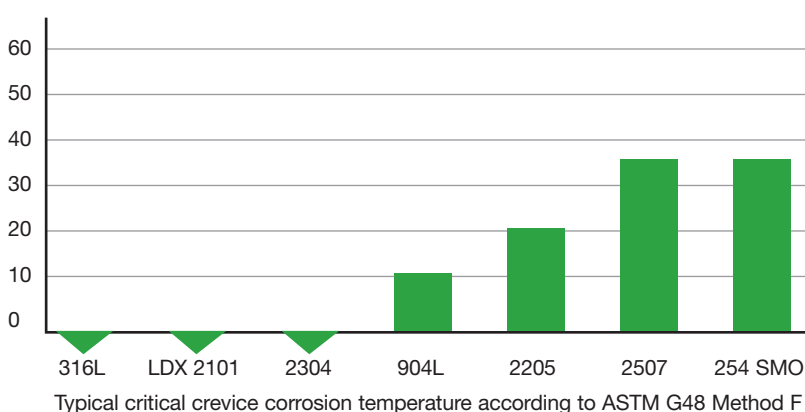
### Pitting Resistance Equivalent PREN = %Cr + 3.3Mo + 30N



## Crevice Corrosion Resistance

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

### CPT, °C



## Stress-Corrosion Cracking Resistance

Chloride stress-corrosion cracking (SCC) is one of the most serious forms of localized corrosion. Higher temperatures and reduced pH will increase the probability of SCC. The onset of SCC is one of the most common reasons for stainless equipment failure. Because of its duplex structure LDX 2101 offers excellent resistance to SCC.

### Results from U-bend testing in a 40% CaCl<sub>2</sub> boiling solution (100°C) for 500 hours

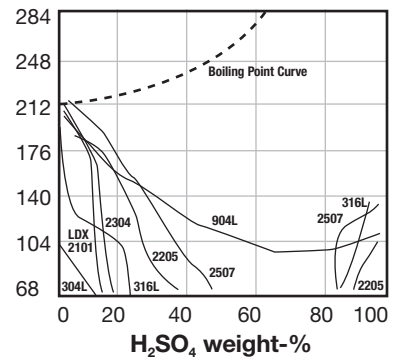
Longitudinal / Transverse	
LDX 2101	No SCC
304L	SSC Cracking (<150hrs)

## General Corrosion

General corrosion is characterized as a uniform attack on a surface in contact with a corrosive medium. The resistance to uniform corrosion in sulfuric acid is shown below. LDX 2101 is superior to 304L and in some cases comparable to 316L.

### Isocorrosion curves, 0.1 mm/year, in sulfuric acid

#### Temperature, °F



### NOTE

LDX 2101 and 254 SMO are registered trademarks of Outokumpu Stainless, Inc. 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.



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