

UREA 25.22.2

A 310 L modified - low Si, high N Stainless Steel for Urea Plants

CLI UREA 25.22.2 chemical composition has been optimised for specific uses in Urea plants. It is a 310L modified austenitic stainless steel with low carbon, low silicon and high nitrogen additions in order to stabilize and strengthen the austenitic phase.

The alloy is designed to obtain a fully austenitic stainless steel free of intermetallic phases as intergranular carbide precipitations which affect drastically the corrosion resistance properties of the alloy in urea containing solutions. The ferrite level is kept under 0.5% in the solution annealing and water quenched conditions.

The alloy is particularly designed for improved corrosion resistance properties in urea carbonate environments including strippers. The grade is also well designed for resistance in wet corrosive conditions due to its high contents of chromium, molybdenum and nitrogen (PREN \geq 33)

STANDARDS

EN 10028-7 X1 Cr Ni Mo N 25.22.2 - 1.4466
AFNOR..... Z2 CND 25.22.AZ
DIN W.Nr 1.4466 / 1.4465
ASTM. 310 Mo LN

CHEMICAL ANALYSIS

Typical values (Weight %)

Typical tensile properties after solution annealing heat treatment

C	Cr	Ni	Mo	N	Others
< 0.02	25	22	2.1	0.12	Si < 0.4 ; Mn < 2

MECHANICAL PROPERTIES

°C	Rp 0.2 MPa	Rp 1.0 MPa	Rm MPa	°F	YS 0.2% KSI	YS 1.0% KSI	UTS KSI	EI%
20	260	290	550	68	38	42	80	40
100	220	250	520	212	32	36	75	40
200	180	200	490	392	26	29	71	40
300	160	180	450	572	23	26	65	40
400	140	150	430	752	20	22	62	40

Impact value : KCV \geq 120 J/cm² (room temperature)

PHYSICAL PROPERTIES

Density : 7,9 kg/m³

Interval Temper °C	Thermal expansion □x10 ⁻⁶ K ⁻¹	°C	°F	Resistivity (μΩ cm)	Thermal conductivity (W.m ⁻¹ .K ⁻¹)	Specific heat (J.kg ⁻¹ .K ⁻¹)	Young modulus E (GPa)	Shear modulus G (GPa)
20-100	16	20	68	95	14	500	200	75
20-300	16.5	200	392	105	16	580	185	70
20-500	17.5	400	752	115	18	650	170	64

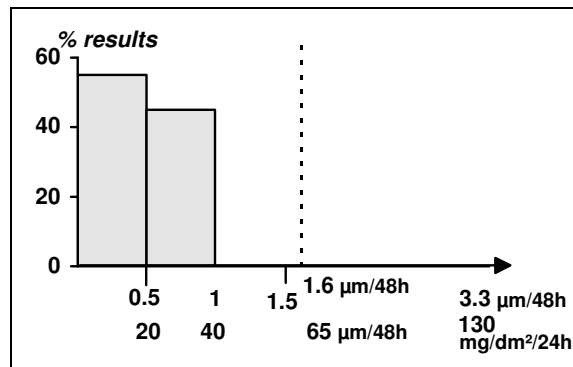
STRUCTURE

Alloy UREA 25.22.2 is a fully austenitic stainless steel which ferrite content is guaranteed lower than 0.5% after solution annealing heat treatment (1140°-1180°C (2084-2156°F) and water quenching. The grain size is generally obtained between 3 and 6. The grain boundaries are free of intermetallic phases or carbide precipitations. The melting practice is optimised in order to improve the cleanliness properties of the steel.

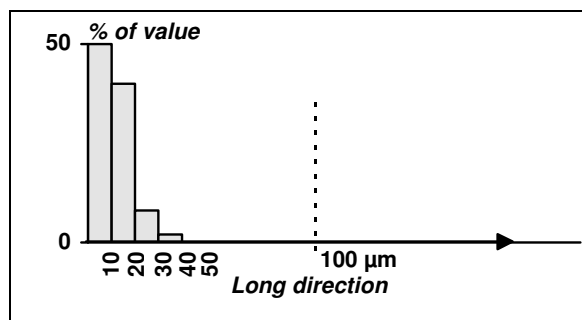
CORROSION RESISTANCE

The UREA 25.22.2 grade is particularly designed for urea applications. The corrosion resistance properties are enhanced thanks to the low carbon level, low silicon level and complementary additions of nitrogen. Typical maximum corrosion results required following different specifications for the 25.22.2 grade after 5 periods of 48 h following ASTM A 262-C practice are : maximum general corrosion : 1,6 μm/48 h or 65 mg/dm² per hour with a maximum depth of microcracks of 100 μm in the long direction of rolling.

CLI UREA 25.22.2 modified grade behaves much better than those maximum values as indicated on the following graph where about 100 tests results obtained between 1994 and 1996 have been reported :



Huey test A 262 C :
General corrosion rate
after 5 periods of 48 h.



Huey test A 262 C :
Selective corrosion
test results
after 5 periods of 48 h

PROCESSING

Hot forming

Hot forming should be carried out in a temperature range of 1200-950°C (2732-1742°F) after the piece has been uniformly heat treated. Final full annealing temperature is required to obtain the requested microstructure. It will be performed at 1140°-1180°C (2084-2156°F) followed by water quenching.

Cold forming

Due to its fully austenitic microstructure, the alloy can be cold formed without any problem. The higher molybdenum content and cold hardening behaviour of the steel explains that it may require more powerful equipments than 304 stainless steel.

Pickling

The UREA 25.22.2 grade must be used in the as pickled and passivated conditions. Pickling treatment may be performed with a nitro-hydrofluoric acid bath (10-20 % HNO₃ - 1.5-5% HF) at 40-60°C (104-140°F).

A 10-20% H₂SO₄ - 1.5-5% HF pickling bath may also be used.

WELDING

Alloy CLI UREA 25.22.2 can be welded with most of the welding processes : TIG, Plasma, MIG welding, as well as SMAW, SAW or FCAW processes. The alloy is sensitive to hot cracking phenomenon due to its fully austenitic microstructure. Weld should be performed in order to obtain extra-low ferrite contents, no carbide or nitride precipitations, low silicon contents as well as no intermetallic phase precipitations. Higher manganese content products should be considered.

Typical chemistry of filler materials to be used is as follow

Cr	Si	Cr	Ni	Mo	Mn	N
<0,03	0,3	24-25	22-23	2,0-2,2	5-6	0,12-0,15

Use basic coated electrodes or fluxes in order to decrease the hot cracking susceptibility. The heat input should be limited to 1,5 kJ/mm and interpass temperature kept below 150°C (302°F).

MACHINING

Operation	Tool	Lubrication	CONDITIONS		
			Blade width mm - inch	Feed mm - inch	Speed (m/min) Speed (feet/min)
Parting off	High speed steel	Cutting oil	1.5 - 0.06	0.03 - 0.0012	10-13 32.8-42.7
			3 - 0.11	0.04 - 0.0016	11-14 36.1-45.9
			6 - 0.23	0.05 - 0.0020	12-15 39.4-49.2
Drilling	High speed steel	Cutting oil	Drill Ø mm - inch	Feed mm - inch	Speed (m/min) Speed (feet/min)
			1.5 - 0.06	0.025 - 0.0010	6-10 19.7-32.8
			3 - 0.11	0.06 - 0.0024	7-11 23.-26.1
			6 - 0.23	0.08 - 0.0031	7-11 23.-26.1
			12 - 0.48	0.10 - 0.0039	7-11 23.-26.1
Milling profiling	High speed steel	Dry or Cutting oil		.05/010 .002/.0039	10-20 32.8-65.6

APPLICATIONS

The steel CLI UREA 25.22.2 is designed for the fabrication of lining interiors in Urea units or complementary products (pipes, fittings...). The grade can be used for urea strippers

SIZE RANGE

	Hot rolled plates	Cold rolled plates	Clad plates
Thickness	5 to 150 mm 3/16" to 6"	2 to 14 mm 5/64" to 5/8"	6 to 150 mm 1/4" to 6"
Width	Up to 3300 mm Up to 130"	Up to 2300 mm Up to 90.5"	Up to 3300 mm Up to 130"
Length	Up to 12000 mm Up to 472"	Up to 8250 mm Up to 325"	Up to 14000 mm Up to 551"

Other sizes are available on request, including 4100mm (161,4") width plates

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 programme on corrosion resistant grades.

We therefore suggest that information be verified at time of enquiry 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.

Further information may be obtained from the following address.

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