

Uremium29 Seamless tubes, pipes and fittings

Tubacex Uremium29 is a highly alloyed duplex stainless steel with excellent corrosion resistance in urea-carbamate solutions.

Tubacex Uremium29 is an austenitic-ferritic stainless steel with high chromium and low nickel contents. Thanks to its duplex structure, and specially due to the passive behaviour of the ferritic phase, Tubacex Uremium29 grade shows high resistance to general corrosion in urea-carbamate environment. It can also be prescribed when high chloride content is expected.

This material presents very good re-passivation properties and high mechanical strength. The resistance to stress corrosion cracking is excellent. The pitting and crevice corrosion resistances are excellent too. It shows good formability and wel-

dability.

Thanks to those properties stated above, Tubacex Uremium29 material can be prescribed for Urea, Caustic Soda or Nitric Acid applications.

In **Urea application**, this grade can be considered as an alternative to Tubacex TXC35 (acc. to 25.22.2), in case of the licensor is already prescribing it. Therefore it can be used for piping systems or carbamate condenser/scrubber/stripper tubes, among others.

Chemical Composition

Typical values (nominal weight %):

Weight (%)									
C	Mn	P	S	Si	Ni	Cr	Mo	N	Cu
<0.030	0.80-1.50	<0.030	<0.030	<0.80	5.8-7.5	28.0-30.0	1.50-2.60	0.30-0.40	<0.80

Reference Standards

- UNS S32906
- ASTM A789, A790, A479
- ASME CODE CASE 2295-3

Forms of Supply

Tubacex Uremium29 seamless tubes and pipes are supplied within a dimension range from OD 6 mm up to OD 72" seamless. Fittings (OD ½" up to OD 72") can also be supplied.

Tubacex Uremium29 seamless tubes and pipes are supplied in straight length as well as U-bent form. Our scope of supply also covers square billets (120 to 500 mm) and round bars (165 to 500 mm).

Production

Steel Making Mill

Electric furnace process and Argon Oxygen Decarburization process (AOD) to refine the steel composition.

Pipe Production Process

Pipe production consists of a hot working stage followed by a final solution annealing treatment conducted in the temperature range 1020-1150°C. After solution annealing, pipes are rapidly cooled down.

Tube Production Process

Tubacex Uremium29 tubing is manufactured via a hot working stage followed by a cold working stage and a final solution annealing performed at 1020-1150°C. After solution annealing, tubes are rapidly cooled down.

Mechanical Properties

For tubes and pipes the following mechanical properties are guaranteed at room temperature:

Wall thickness (mm)	Rp 0.2% (MPa)	Rm (MPa)	A2 (%)	HRC
< 10	min. 650	min. 800	min. 25	max. 32
> 10	min. 550	min. 750	min. 25	max. 32

Physical Properties

Values referred here must be considered at room temperature:

Density:

g/cm ³
7,8

Thermal conductivity:

W/(m·K)
17

Modulus of elasticity:

GPa
205

Also the following properties shall be considered:

Specific heat:

Temperature degree centigrade	J/(g·K)
25	0,45
100	0,48
200	0,51
300	0,54

Average thermal expansion coefficient:

Temperature degree centigrade	10 ⁻⁶ /K
25-100	13
25-200	13,5
25-300	13,5

Microstructure

Homogeneous ferrite-austenite microstructure with a ferrite content in the range 40-60%. Microstructure is free of intermetallic phases and chromium nitrides.

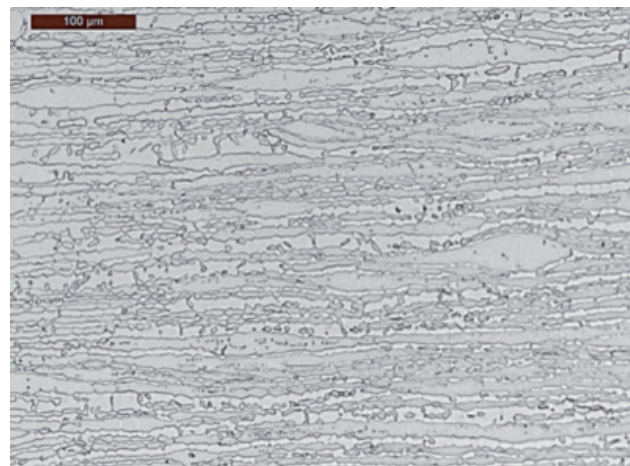


FIGURE 1. Tubacex Uremium29 typical austenite-ferrite microstructure.

Corrosion Resistance

Intergranular Corrosion

Tubacex Uremium29 presents excellent intergranular corrosion response. It's low purity content and appropriate heat treatment performed during production guarantee the absence of precipitates and intermetallic phases.

This good corrosion behavior can be measured by typical intergranular corrosion tests used for urea application: Streicher test and Huey test.

ASTM A262 Practice B (STREICHER test):

ASTM A262 B corrosion practice (ferric sulfate - sulfuric acid test) is the test usually used to evaluate the corrosion response of this duplex-type material in urea applications. The results of this test in different pipe/tube dimensions together with the main urea licensors' requirements are shown in the graph below.

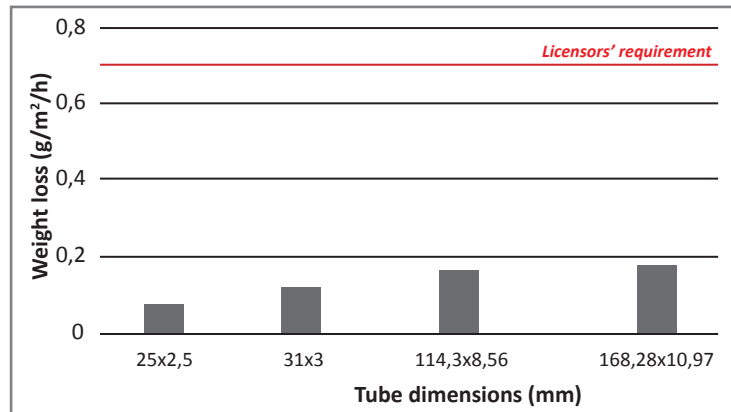


FIGURE 2.
Examples of Streicher test results on Tubacex Uremium29 samples.

ASTM A262 Practice C (HUEY test):

ASTM A262 C corrosion practice (boiling nitric acid test) is the corrosion practice commonly used in austenitic urea grades to evaluate their corrosion resistance. Tubacex Uremium29 also shows very good response under this test, as the measured weight losses are well below the requirements of the main urea licensors.

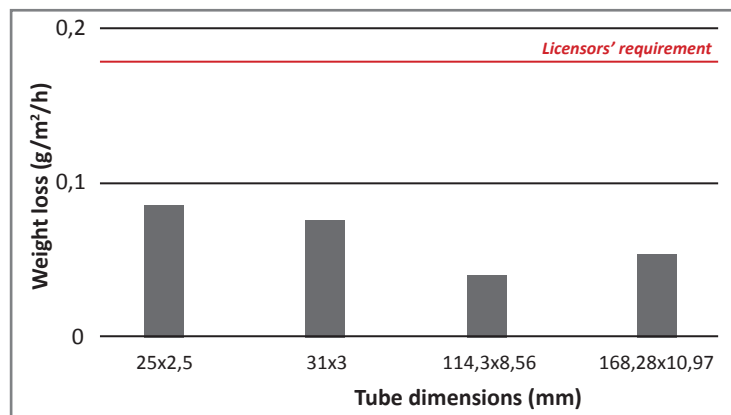


FIGURE 3.
Examples of weight loss of Tubacex Uremium29 steel grade after HUEY tested.

Results regarding Selective attack are extremely good in both tests. Maximum 10µm Selective attack value results obtained in Streicher and Huey tests, together with the Weight loss values showed above, guarantee a good performance of the material when in use. As a reference, the limit of penetration of Selective attack stated in main licensor's Specification is 100 µm.

Pitting And Crevice Corrosion Resistance

Compared to the typical austenitic grades used in urea environment, 316L UG and 25.22.2, Tubacex Uremium29 has higher resistance to pitting and crevice corrosion as a result of a duplex structure suitably balanced with Mo and N additions and a higher chromium content.

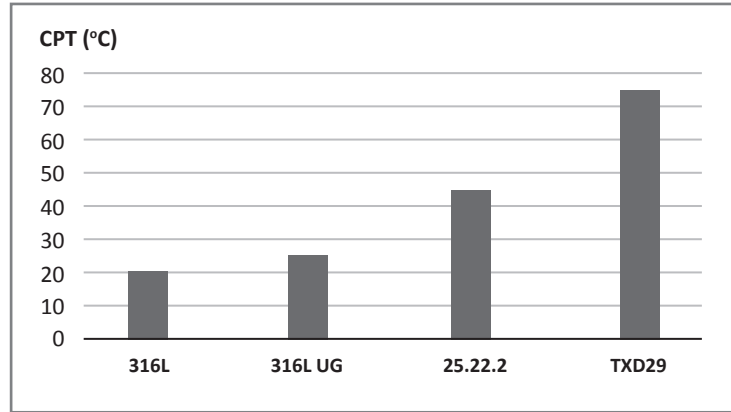


FIGURE 4.
Examples of weight loss of Tubacex Uremium29 steel grade.

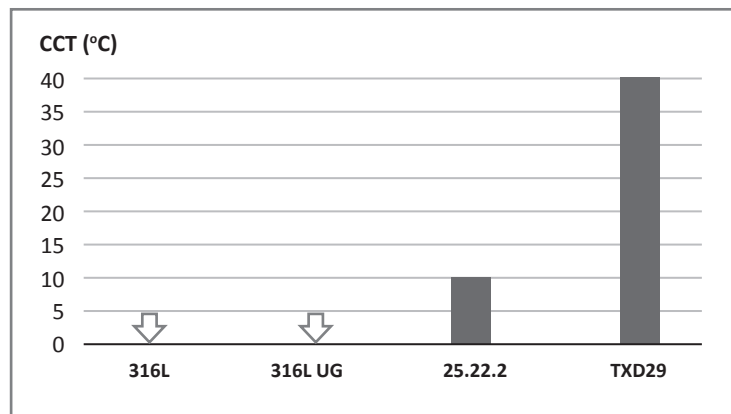


FIGURE 5.
Critical Crevice Temperature according to ASTM G48 method F.

Stress Corrosion Cracking

Chloride stress corrosion cracking normally initiates from sites of active pitting or crevice corrosion. As previously mentioned, Tubacex Uremium29 presents higher resistance to these types of localized corrosion than the austenitic stainless steels typically used in urea environment, such as 316L UG and 25.22.2, and, hence, to stress corrosion cracking.

This technical datasheet contains general information about Tubacex Uremium29 steel grade. For case to case suitability, please contact TUBACEX. Visit our website www.tubacex.com or contact our experts (fertilizer.sales@tubacex.es) for further information.