

TXC35 Seamless tubes, pipes and fittings

Tubacex TXC35 is an austenitic stainless steel especially developed for the Urea Industry. The challenging corrosive environment in the Fertilizer industry requires more demanding steel properties. TUBACEX TXC35 is mainly used in Urea plants for stripper, condenser, scrubber and HP piping systems. This stainless steel grade offers high corrosion resistance to ammonium carbamate, as well as good resistance to intergranular/pitting and crevice corrosion. Furthermore, it has good welding properties.

These features make this steel grade (often referred to as 25.22.2 in the industry) the most popular for Urea High Pressure application.

TUBACEX TXC35 is a fully austenitic grade with **low impurities, low carbon, low silicon and high Nitrogen**, Chromium and Molybdenum contents.

TUBACEX boasts over **40 years experience** in supplying TXC35 for High Pressure Urea equipment, proving that the properties of this grade are **well-suited for such extreme corrosive environments**.

Chemical Composition

TXC35 typical values (nominal weight %)

Weight (%)								
C	Mn	P	S	Si	Cr	Ni	Mo	N
<0.020	1.5 to 2.00	<0.020	<0.010	<0.40	24.50 to 25.50	21 to 23	2.00 to 2.30	0.10 to 0.15

Reference Standards

- UNS – S31050 in accordance with ASTM A213 and ASTM A312
- EN – 1.4466 in accordance with EN 10216-5 and EN 10297-2
- VdTÜV – 1.4466 in accordance with VdTÜV material data sheet 415/2

Also known as:

- X1 Cr Ni Mo N 25 22 2 as per EN 10216-5 and EN 10297-2
- 02Cr25Ni22NMo2 as per GOST
- TP310MoLN as per ASTM

Technical Specifications

TXC35 fulfils all of the leading Urea Technology licensor's specifications, such as:

- Saipem
- Stamicarbon
- Casale
- Toyo

Forms of Supply

TUBACEX TXC35 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 TXC35 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).

Mechanical Properties

Values referred to here are applicable to tubes and to wall thickness below 6mm and above 6mm.

Tensile Properties

At 20 degree centigrade (68 F) temperature (According to ASTM A 213 and ASTM A 312):

	Wall thickness ≤6 mm		Wall thickness >6mm	
	Mpa (Minimum)		Mpa	
Rp 0.2%	270		255	
Rm	580		540	
A	25		25	

	Wall thickness ≤6 mm		Wall thickness >6mm	
	ksi (Minimum)		ksi	
Rp 0.2%	39		37	
Rm	84		78	
A	25		25	

At 20 degree centigrade (68 F) temperature (According to VdTUV material data sheet 415/2):

	Wall thickness ≤6 mm		Wall thickness >6 mm	
	Hot finished	Cold finished		
	MPa (Minimum)		Mpa (Minimum)	
Rp 0.2 %	270	350	255	
Rp 1%	300	380	285	
Rm	580 (Max 780)	650 (Max 880)	570 (Max 770)	
A	30	25	30	

	Wall thickness ≤6 mm		Wall thickness >6 mm	
	Hot finished	Cold finished		
	Ksi (Minimum)		Ksi (Minimum)	
Rp 0.2 %	39.0	50.7	37.0	
Rp 1%	43.5	55.1	41.3	
Rm	84 (Max 113.1)	94.2 (Max 127.6)	82.6 (Max 111.6)	
A	30	25	30	

At high temperature (According to VdTUV material data sheet 415/2 and wall thickness <6 mm):

Temperature degree centigrade/F	Hot Finished		Cold Finished	
	Rp 0.2% Mpa	Rp 1% Mpa	Rp 0.2% Mpa	Rp 1% Mpa
	Mpa (Minimum)	Mpa (Minimum)	Mpa (Minimum)	Mpa (Minimum)
100 (212)	230	260	300	340
200 (392)	200	230	280	315
300 (572)	175	205	235	260
400 (752)	155	185	210	225

Temperature degree centigrade/F	Hot Finished		Cold Finished	
	Rp 0.2% Mpa	Rp 1% Mpa	Rp 0.2% Mpa	Rp 1% Mpa
	Ksi (Minimum)	ksi (Minimum)	ksi (Minimum)	ksi (Minimum)
100 (212)	33.3	37.7	43.5	44.8
200 (392)	29.0	33.3	40.6	45.6
300 (572)	25.3	29.7	34.0	37.7
400 (752)	22.4	26.8	30.4	32.6

At high temperature (According to VdTUV material data sheet 415/2 and wall thickness > 6 mm):

Temperature degree centigrade/F	Hot Finished	
	Rp 0.2% Mpa	Rp 1% Mpa
	Mpa (Minimum)	Mpa (Minimum)
100 (212)	215	245
200 (392)	185	215
300 (572)	160	190
400 (752)	140	170

Temperature degree centigrade/F	Hot Finished	
	Rp 0.2%	Rp 1% Mpa
	Ksi (Minimum)	ksi (Minimum)
100 (212)	31.1	35.5
200 (392)	26.8	31.1
300 (572)	23.2	27.5
400 (752)	20.3	24.6

Hardness

HRB (HBW)
Maximum 95 (217)

Impact strength

According to EN 10216-5, the mean notch impact energy at 20 degree centigrade of three test pieces taken in longitudinal direction shall be higher than 100J. An individual value may be below 100 J provided that it is not lower than 70% of value.

According to VdTUV material data sheet 415/2, the mean notch impact energy at 20 degree centigrade of three test pieces taken in longitudinal direction shall be higher than 120J for hot finished tubes/pipes and higher than 80 J for cold finished tubes. An individual value may be below required values provided that it is not lower than 70% of value.

TUBACEX TX35 fulfils EN 10216-5 requirements regarding impact strength.

Physical Properties

Values referred to here are applicable to tubes and to wall thickness below 6mm and above 6mm.

Density:

g/cm ³
7.9

Relative magnetic permeability at 6400-55700:

A/m
1.003

Thermal conductivity:

Temperature degree centigrade/F	W/(m.k)	BTU/(ft.h.f)
20 (68)	13.0	8
100 (212)	15.0	9
200 (392)	17.0	10
300 (572)	19.0	11
400 (752)	21.0	13
500 (932)	23.0	13

Elastic modulus:

Temperature degree centigrade/F	10 ³ MPa	10 ³ ksi
20 (68)	195	(28.3)
100 (212)	190	(27.6)
200 (392)	182	(26.3)
300 (572)	174	(25.5)
400 (752)	166	(24.2)
500 (932)	158	(23.1)

Coefficient of thermal expansion:

Temperature degree centigrade/F	10 ⁻⁶ K ⁻¹	10 ⁻⁶ F ⁻¹
20 (68) - 100 (212)	15.7	8.6
20 (68) - 200 (392)	16.4	9.0
20 (68) - 300 (572)	16.7	9.2
20 (68) - 400 (752)	17.1	9.3
20 (68) - 500 (932)	17.4	9.5
500 (932)	158	(23.1)

Corrosion Resistance

Our experience over the past 40 years has shown that TUBACEX TXC35 has excellent corrosion resistance to carbamate solution, making it the preferred choice for carbamate condensers, strippers and other High Pressure applications within the HP-urea synthesis. This extensive experience enables TUBACEX to make the appropriate changes within the general specifications in order to enhance the corrosion properties of the material.

Intergranular Corrosion

TUBACEX TXC35 has very good resistance to intergranular corrosion. Statistical assessment of the Huey test reveals a very stable result at a level far below licensor specifications. Historical Tubacex TXC35 Huey test values (performed in both internal and external laboratories) show an excellent performance of the material. Since environmental conditions are different, on-stream corrosion rates are usually better than Huey test values determined in tube samples prior to assembly in the vessel. Apart from weight-loss, selective attack is another important requirement of the Huey test. TUBACEX typical values do not exceed 15µm.

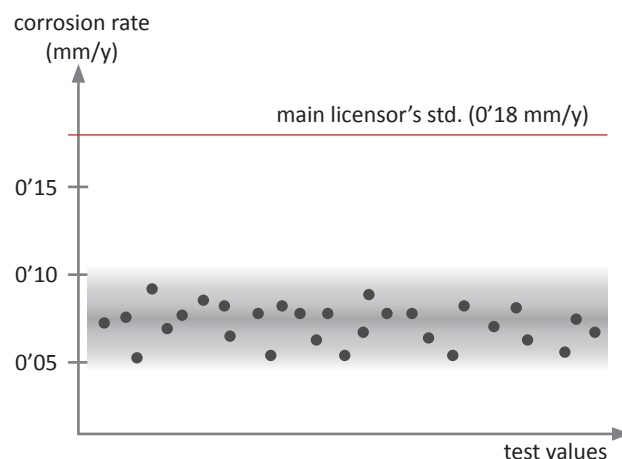


FIGURE 1. TXC35 huey test values show typical tubacex values below 0.1 mm/y, with an average of around 0.065 mm/y.

Pitting and Crevice Corrosion

Compared to other austenitic steels, such as 316L or 316L UG, TUBACEX TXC35 offers higher resistance to pitting and crevice corrosion as a result of a chemical composition suitably balanced with Mo and N additions and a higher Chromium content.

Stress Corrosion Cracking

Chloride stress corrosion cracking normally initiates from sites of active Pitting or Crevice corrosion. As previously mentioned, TUBACEX TXC35 presents higher resistance to these types of localized corrosion than other austenitic stainless steels, such as 316L and 316L UG and, hence, to stress corrosion cracking.

Heat Treatment

Tubes can be solution annealed in the temperature range of 1050-1100 °C (1920-2010 °F). After solution annealing, tubes should be rapidly water quenched.

Welding

TUBACEX TXC35 has good welding properties. Welding should be conducted without pre-heating. Subsequent heat treatment is not required. Different welding methods are possible. An austenitic filler material should be used to prevent cracks in the welded material.

Welding must be carried out following the same precautions as for other austenitic stainless steels so as to avoid any material distortions. Stress relief can be carried out after welding, if required.

Please contact TUBACEX for heat treatment guidelines/procedures and recommended suppliers.

Bending

TUBACEX TXC35 has excellent formability. Both hot and cold bending are permitted. Cold bending is possible up to small bending radii. Solution annealing after cold bending is allowed, though not necessary. Hot bending can be carried out without subsequent heat treatment.

This technical datasheet contains general information about TXC35 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.

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