

General Characteristics

TX-28N is a superaustenitic stainless steel specially designed to work for extremely corrosive media in the most aggressive environments of Oil Country Tubular Goods.

TX-28N is a nickel-iron-chromium alloy with additions of molybdenum and copper. It is characterised by its high resistance to corrosion in sour environments. The resistance to stress corrosion cracking in presence of H2S, CO2 and Chlorides is excellent, therefore it is a very good candidate to be used downhole in Oil &Gas wells working in extreme conditions.

A. Technical Specifications

- ISO 13680
- API 5CRA
- ISO 15156/NACE MR0175

B. Chemical Composition

Typical values are (in percentage of mass). UNS number is N08535:

С	Мn	Si	Ρ	S	Cr	Ni	Мо	Cu	PREN
<0.02	< 1.0	<0.30	< 0.030	< 0.002	25.5	31.5	3.5	0.90	> 35

This composition guarantees PREN > 35, as per following formula: PRE = $%Cr + 3.3 \times %Mo + 16 \times %N$

C. Production process

C.1 STEEL MAKING MILL

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

C.2 PIPE PRODUCTION

The pipe production consists in a first hot working stage followed by a final cold working stage.

C.3 HEAT TREATMENT

Depending on the final product requirements a heat treatment prior to the cold work could be applied. Minimum heat treatment temperature is 1080 °C (1976 °F) followed by a rapid cooling.

TX28N

D. Mechanical Properties (cold worked condition)

Different yield strength grades are available. The most typical one is 110 ksi

At 20 °C	Grade 110
Ys0,2% (ksi)	110 - 140
Ts (ksi)	> 120
A (%)	> 11
HRC	< 33
Impact test (*)	Av>50J / Ind>40J

Temperature yield derating factor at a given temperature:

Temperature °C (°F)	Yield Derating Factor			
100 (212)	0,93			
200 (392)	0,89			

1 ksi = 6,895 MPa - 1 MPa = 0,145 ksi (*) At -10 °C, transverse

E. Physical Properties

E.1 THERMAL EXPANSION COEFFICIENT:

Mean coefficient between 20 °C and a given temperature:

Temperature °C (°F)	Coefficient (10-6 K-1)
100 (212)	15,2
200 (392)	15.5

E.2 MODULUS OF ELASTICITY

At 20 °C: 190 kN/ mm². At a given temperature:

Temperature °C (°F)	kN/ mm²		
100 (212)	190		
200 (392)	180		

E.3 POISSON RATIO

At 20 °C: 0,31. At a given temperature:

Temperature °C (°F)	v
100 (212)	0,30
200 (392)	0,31

TX28N

E.4 OTHER PHYSICAL PROPERTIES:

- Density at 20 °C: 7.98 g/cm³
- Thermal conductivity at 20 °C: 11 W/K·m
- Electrical resistance at 20 °C: 0.81 Ω·mm²/m
- Specific heat capacity at 20 °C: 455 J/kg °C

F. Corrosion Properties

F.1. INTERGRANULAR CORROSION

TX-28N passes testing to ASTM A262 Practice E, ISO 3651-2 Method A and G28A without objections.

F.2. STRESS CORROSION CRACKING

F.2.1 Slow strain rate test (SSRT) method for screening CRAs for SCC in sour oilfield service (NACE TM0198)

CONDITION	Grade	Strain rate s-1	CI [—] (ppm)	РН	T ℃ (℉)	P H2S kPa (psi)	P CO2 kPa (psi)
1	110	4,00 10-6	150000	3,5	120 (248)	572 (83)	1138 (165)
2	110	4,00 10-6	280000	5,0	149 (300)	2068 (300)	1241 (180)
3	110	4,00 10-6	151500	2,0	149 (300)	690 (100)	-

TX-28N grade 110 passes without objections the tests carried out within the ISO 15156 limits for this grade and even at more aggressive conditions:



F.3. PITTING AND CREVICE CORROSION RESISTANCE

According to ASTM G48, TX-28N has a critical pitting temperature higher than 35°C and a critical crevice temperature higher than 20°C.