TUBACEX
TX 825
Technical Data Sheet

Introduction

TX825 is a nickel-iron-chromium alloy with additions of molybdenum, copper and titanium. It is characterised by its high resistance to general corrosion in different environments. The resistance to stress corrosion cracking is excellent and it is specially selected to be part of the oil and gas wells exposed to the most aggressive sour conditions.

General Characteristics

TX-825 is a austenitic nickel-iron-chromium alloy with additions of molybdenum, copper and titanium. It has excellent resistance to both reducing and oxidizing acids, to stress-corrosion cracking, and to localized attack. The alloy is especially resistant to sulphuric and phosphoric acids.

A. Technical Specifications

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

B. Chemical Composition

Typical values are (in percentage of mass):

Weight (%)										
C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Ti	PREN
<0.02	< 1,00	0.20	< 0.030	< 0.002	21,5	42	3.0	2	0,8	> 32

This composition guarantees PREN > 32, as per following formula:

PRE = %Cr + 3.3 x %Mo + 16 x %N

C. Production Process

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

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

HEAT TREATMENT
Depending on the final product requirements a heat treatment prior to the cold work could be applied.

D. Mechanical Properties (Cold Worked Condition)

Different yield strength grades are available. The most typical ones are 110 and 125 ksi.

At 20 °C	Grade 110	Grade 125
$Ys_{0,2\%}$ (ksi)	110 – 140	125 – 150
Ts (ksi)	> 120	> 135
A (%)	> 11	> 10
HRC	< 33	< 37
Impact test (*)	Av>50J / Ind>40J	

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

Temperature yield derating factor at a given temperature:

Temperature °C (°F)	Yield Derating Factor
100 (212)	0,96
200 (392)	0,91

E. Physical Properties

1. Thermal Expansion Coefficient:

Mean coefficient between 20 ºC and a given temperature:

Temperature °C (°F)	Coefficient (10^{-6} K^{-1})
100 (212)	14
200 (392)	15

2. Modulus of Elasticity

At 20 ºC: 190 kN/ mm². At a given temperature:

Temperature °C (°F)	kN/ mm²
100 (212)	186
200 (392)	183

3. Poisson ratio

At 20 ºC: 0,40. At a given temperature:

Temperature °C (°F)	V
100 (212)	0,40
200 (392)	0,41

4. Other Physical Properties:

- Density at 20 ºC: 8,10 g/cm³
- Thermal conductivity at 20 ºC: 11 W/K·m
- Electrical resistance at 20 ºC: 1,13 Ω·mm²/m
- Specific heat capacity at 20 ºC: 440 J/kg ºC

F. Corrosion Properties

1. Intergranular Corrosion

TX-825 passes testing to ASTM A262 Practice E, ISO 3651-2 Method A and G28A without objections.

2. Stress Corrosion Cracking

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

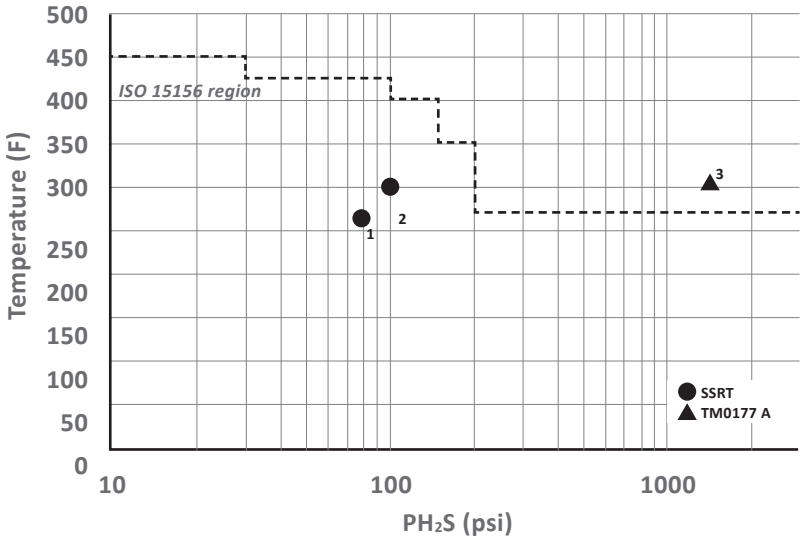
Condition	Grade	TEST	Strain rate s-1	Cl^-(ppm)	pH	T ºC (ºF)	P H_2S kPa (psi)	P CO_2 kPa (psi)
1	110	NACE TM0198 SSRT	4,00 10-6	185000	5,0	140 (284)	538 (78)	1103 (160)
2	140	NACE TM0198 SSRT	4,00 10-6	151500	2,0	149 (300)	690 (100)	-

Resistance to SCC in H2S environment (NACE TM0177 method A)

Condition	Grade	TEST	Cl^- (ppm)	Applied Sress	pH	T ºC (ºF)	P H_2S kPa (psi)	P CO_2 kPa (psi)
3	110	NACE TM0177 METHOD A	220000	90% SMYS	3,0	152 (306)	9653 (1400)	3861 (560)

Resistance to SCC in H2S environment (comparison with ISO 15156)

TX-825 grade 110 passes without objections the tests carried out within the ISO 15156 limits for this grade and even at more aggressive conditions:



3. Pitting and Crevice Corrosion Resistance

According to ASTM G48, TX-825 has a critical pitting temperature higher than 25°C.