

## TP410

### Material

TP410, S41000, 1.4006, X12Cr13, 1Cr13

### Overview

TP410 is a martensitic stainless steel that provides good corrosion resistance, high thermal strength, hardness, toughness and cold deformation properties. Its shock absorption is also very good. It is magnetic in both the annealed and hardened conditions. A wide of properties can be achieved with different heat treatments. Applications requiring moderate corrosion resistance and high mechanical properties are ideal for this stainless steel.

### Characteristics

TP410 stainless steel has good corrosion resistance and machinability

The “straight-chromium” type tubing is characterized by being ferromagnetic. TP410 is amenable to hardening by heat treatment, and the high-chromium, ferritic alloys are sensitive to notch-brittleness on slow cooling to ordinary temperatures. These features should be recognized in the use of this materials.

### Application

TP410, commonly known as “straight-chromium” type stainless steel tubing, is for general corrosion resisting and high temperature service.

TP410 is usually used for the production of weak corrosion resistance medium and load bearing parts, mainly used for higher toughness, certain corrosion resistance and impact load bearing parts, can also be made in the normal temperature conditions of weak corrosion resistance medium equipment and parts.

### Chemical composition

TP410 as per ASTM A268 (wt%)

C	Si	Mn	P	S	Cr
≤0.15	≤1.00	≤1.00	≤0.040	≤0.030	11.5~13.50
Ni	Mo	Cu	Sn	Al	N
≤0.75	≤0.50	≤0.50	≤0.05	≤0.05	≤0.080

## Physical property

- (1) Density: 7.75 g/cm<sup>3</sup> (0.28 lb/in<sup>3</sup>) (1kg/m<sup>3</sup> = 0.001g/cm<sup>3</sup> = 0.0624 lb/ft<sup>3</sup>)
- (2) Electrical Resistivity: 68°F(20°C): 22.5(57.0) microhm-in (microhm-cm):
- (3) Specific Heat: BTU/Ib/°F(kJ/kg ·K): 32-212°F(0-100°C): 0.11(0.46)
- (4) Thermal Conductivity: BTU/hr/ft<sup>2</sup>/ft/°F (W/m ·K):  
At 212°F(100°C): 14.4(24.9)  
At 932 °F(500°C): 16.6(28.7)
- (5) Mean Coefficient of Thermal Expansion: in/in/°F (um/m ·K)  
32-212°F(0-100°C): 5.5×10<sup>6</sup>(9.9)  
32-1200°F(0-649°C): 6.5×10<sup>6</sup>(11.6)
- (6) Modulus of Elasticity: ksi (MPa) 29×10<sup>3</sup> (200× 10<sup>3</sup>) in tension
- (7) Magnetic Permeability: Magnetic
- (8) Melting Range: 2723°F(1495°C)

## Mechanical property (in annealed condition)

Temper	316LVM	
Tensile Rm	60	ksi (min)
Tensile Rm	415	MPa (min)
Rp. 0.2% Yield	30	ksi (min)
Rp. 0.2% Yield	205	MPa (min)
Elongation (2" or 4D gl)	20	% (min)

## Heat treatment and hardness

TP410 can be hardened by cold working and heat treating.

High temperature or low temperature tempering is required, but tempering should be avoided between 370 and 560°C.

As a final heat treatment, tubes shall be reheated to a temperature of 1200 °F [650 °C] or higher and cooled (as appropriate for the grade) to meet the requirements of this specification.

Hardness: max. 207 HBW or 95 HRB

Solution Annealed & Double Tempered condition to meet NACE (22 HRC max)

## Micro structure

The metallographic structure is characterized by martensitic type.

## Available Process

- (1) Cold worked
- (2) Cold worked and bright annealed
- (3) Cold worked, annealed and pickled
- (4) Cold worked, polished (MP, EP etc.)
- (5) Cold worked, bright annealed, polished (MP, EP etc.)