New Castle Stainless Plate, LLC

Type 410

UNS S41000

General Properties

Type 410 is the basic martensitic stainless steel and it can be hardened by a "quench-and-temper" heat treatment. It contains a minimum of 11.5% chromium, sufficient to give corrosion resistance properties. It achieves maximum corrosion resistance when it has been hardened and tempered and then polished.

Martensitic stainless steels are optimized for high hardness, and other properties are to some degree compromised. Corrosion resistance of the martensitic grades is lower than that of the common austenitic grades, and their useful operating temperature range is limited by their loss of ductility at sub-zero temperatures and loss of strength by over-tempering at elevated temperatures.

Type 410 is a martensitic stainless steel and is ferromagnetic.

Plate Product Sizes

Plate product is available up to 4 inches thick and up to 96 inches wide.

Design Features

- Good resistance to atmospheric corrosion
- Oxidation resistant to 1500˚F
- High surface hardness after heat treating
- Good machinability in the annealed condition

Applications

- Refinery equipment
- Flat springs and cutlery
- Petrochemical equipment
- Mineral processing equipment

Chemical Composition (wt%) *Table 1*

	C	Mn	Cr	Ni	Mo	N	Other
Typical	0.11	0.5	12.4	0.3	0.03	0.05	
ASME SA-240	0.08-0.15	≤1.00	11.5-13.5	≤0.75	...	...	
ASTM A240	0.08-0.15	≤1.00	11.5-13.5	≤0.75	...	...	

Specifications

Type 410 can be supplied to meet ASTM specifications.

Corrosion resistance

Type 410 is a versatile, general-purpose stainless steel that is used widely where corrosion is not severe and high hardness and high strength are required.

Heat treatment

Annealing

Type 410 should be annealed in the 1500-1650℉ (815-900℃) range, furnace cooled to 1100℉ (593℃) and then air cooled.

Process Annealing

Type 410 should be process annealed in the 1350-1450℉ (732-788℃) range and then air cooled.

Hardening

Type 410 should be hardened in the 1700-1850℉ (925-1010℃) range, air cooled or oil quenched followed by stress relieving or tempering.

Stress Relieving

Type 410 should be stress relieved in the 300-800℉ (150-425℃) range and then air cooled.

Tempering

Type 410 should be tempered in the 1100-1400℉ (590-760℃) range and then air cooled.

Mechanical Properties per ASTM A240 *Table 2*

	Typical	Requirement
Yield Strength $R_{p0.2}$ (KSI)	43	30 min
Tensile Strength R_m (KSI)	75	65 min
Elongation (%)	35	20 min
Hardness (Rockwell B)	84	96 max

Physical Properties *Table 3*

	Typical
Density (lb/in^3)	0.278
Modulus of Elasticity (psi)	31.1x10^6
Coefficient of Thermal Expansion 68-212°F [µin/(in*°F)]	5.83
Thermal Conductivity [BTU/(hr*°F)]	17.3
Thermal Capacity [BTU/(lbm*°F)]	0.11
Electrical Resistivity (µΩ*in)	23.62

Workability

Cold Working

Type 410 is readily formed and fabricated through a full range of cold working operations in the annealed condition. Type 410 can be blanked, drawn, spun, and roll formed and cold headed. Cold working operations will slightly increase the strength and hardness of the material.

Hot Working

Type 410 can be forged in the 1650-2100°F range and air cooled.

Welding

Type 410 has limited weldability due to its hardenability. Post-weld heat treatment should be considered to achieve the required properties. AWS E410/ER410, E410NiMo/ ER410NiMo and E309L/ER309L filler metals are most often specified for welding Type 410 stainless steel. Readily welded by all standard methods, but a pre-heat of 300-500℉ (150-260°C) and post-weld annealing treatment is required to reduce the possibility of cracking. Use 410 welding filler if post hardening and tempering is involved. If parts are to be used in the "as welded" condition, a ductile joint can be achieved by using 309L weld filler.

Machinability

Type 410 should be machined in the annealed condition using surface speeds of 60-80 ft/min. The best machining results are achieved with slower speeds, heavier feeds, excellent lubrication, sharp tooling, and powerful, rigid equipment.

Technical Support

New Castle assists users and fabricators in the selection, qualification, installation, operation, and maintenance of 6% Mo stainless steel. Technical personnel can draw on years of field experience with these grades to help you make the technically and economically correct materials decision. New Castle is prepared to discuss individual applications and to provide data and experience as a basis for selection and application of 6% Mo stainless steels.

New Castle works closely with its distributors, fabricators, and end users to ensure timely availability of 6% Mo stainless steel in the sizes and quantities required by the user. For assistance with technical questions and to obtain top quality products, call New Castle at 1-800-349.0023.

New Castle

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