

440A

STAINLESS STEEL



Cutlery

Crushing Machines

Dental Instruments

Surgical Instruments

TYPES 440A is a high-carbon, martensitic stainless steel developed to provide stainless properties with maximum hardness. It is magnetic in both the annealed and hardened conditions. Maximum hardness and corrosion resistance are available only in the hardened or hardened and stress-relieved conditions, so the alloy is not used in the annealed or annealed and tempered conditions.

Dental, surgical instruments and cutlery are frequent applications for Type 440A.

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Product Description

Composition		(wt %)
Carbon	(C)	0.06 – 0.75
Manganese	(Mn)	1.00 max.
Phosphorus	(P)	0.040 max.
Sulfur	(S)	0.030 max.
Silicon	(Si)	1.00 max.
Chromium	(Cr)	16.0 – 18.0
Molybdenum	(Mo)	0.75 max.

AVAILABLE FORMS

Cleveland-Cliffs produces Type 440A in coils and cut lengths in thicknesses 0.010 – 0.145 in. (0.25 – 3.68 mm) and widths up to and including 26 in. (660 mm).

PHYSICAL PROPERTIES

Density, lbs/in. ³ (g/cm ³)	0.28 (7.74)
Electrical Resistivity, $\mu\Omega \cdot \text{in.}$ ($\mu\Omega \cdot \text{cm}$) 70 °F (21 °C)	23.68 (60)
Thermal Conductivity, BTU/hr./ft. ² /°F W/(m·K) 212 °F (100 °C)	14.0 (24.2)
Coefficient of Thermal Expansion, in./in./°F ($\mu\text{m}/\text{m}/\text{K}$) 32 – 212 °F (0 – 100 °C)	5.6×10^{-6} (10.6)
Modulus of Elasticity, ksi. (MPa)	29.0×10^3 (200×10^3)
Specific Heat, BTU/lbs./°F (kJ/g/K) 32 – 212 °F (0 – 100 °C)	0.11 (0.46)

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Properties

TYPICAL MECHANICAL PROPERTIES

	UTS, ksi. (MPa)	0.2% YS, ksi. (MPa)	Elongation % in 2 in. (50.8 mm)	Rockwell Hardness
Annealed	105 (724)	60 (414)	20	B95
Hardened and Stress Relieved	260 (1793)	240 (1655)	5	C57

METRIC CONVERSION

The values shown in this bulletin were established in U.S. customary units. The metric equivalents of U.S. customary units shown may be approximate.

CORROSION RESISTANCE

Type 440A provides good corrosion resistance in the hardened and stress-relieved condition. It is resistant to fresh water, steam, crude oil, gasoline, perspiration, alcohol and foodstuffs.

HEAT TREATMENTS

Full Annealing: Heat uniformly at 1500 – 1600 °F (816 – 871 °C), soak and cool slowly in furnace to 1000 – 1200 °F (538 – 649 °C) at a rate of 20 – 50 °F (11 – 27 °C) per hour, then cool in air, oil or water.

Process Annealing: Heat at 1350 – 1450 °F (732 – 788 °C), then cool very slowly in the furnace.

Hardening: Preheat slowly to 1450 °F (788 °C) and soak, then raise temperature to 1850 – 1950 °F (1010 – 1066 °C), quench in warm oil or air. Produces Rockwell Hardness of C55 – 58. Stress relieve immediately. A subzero treatment of -100 °F (-73 °C) is recommended in order to obtain maximum hardness

Stress Relieving: Heat to 300–800°F (149–427°C) for 1 to 3 hours, air cool.

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WELDABILITY

The martensitic class of stainless steels has limited weldability due to the hardenability of these alloys. Special consideration is required to avoid cold cracking by preheating to about 550 °F (260 °C). Post-weld heat treatment should be considered to achieve required properties. This particular alloy is generally considered to have much poorer weldability than the most common alloy of this stainless class, Type 410. A major difference is the very high carbon content for this alloy which requires both preheat and post-weld heat treatment. When a weld filler is needed, AWS E/ER 309 and Cleveland-Cliffs 410 NiMo are most often specified. Type 440A is well known in reference literature and more information can be obtained in this way.

FORMABILITY

Type 440A can be moderately cold-formed with only slightly more difficulty than the lower-carbon, lower-chromium grades of stainless steel if it is annealed for maximum softness.

About Cleveland-Cliffs Inc.

Cleveland-Cliffs is the largest flat-rolled steel producer in North America. Founded in 1847 as a mine operator, Cliffs also is the largest manufacturer of iron ore pellets in North America. The Company is vertically integrated from mined raw materials and direct reduced iron to primary steelmaking and downstream finishing, stamping, tooling, and tubing. The Company serves a diverse range of markets due to its comprehensive offering of flat-rolled steel products and is the largest steel supplier to the automotive industry in North America. Headquartered in Cleveland, Ohio, Cleveland-Cliffs employs approximately 25,000 people across its mining, steel and downstream manufacturing operations in the United States and Canada.



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