

410S STAINLESS STEEL



- Minimal Hardenability
- Good High-temperature Service
- Retards Hardening Cracks When Welded

Applications Potential

Because AK Steel 410S cools from elevated temperatures without marked hardening, it is particularly useful for annealing boxes, quenching racks, oxidation-resistant partitions and other high-temperature units.

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Data referring to mechanical properties and chemical analyses are the result of tests performed on specimens obtained from specific locations of the products in accordance with prescribed sampling procedures; any warranty thereof is limited to the values obtained at such locations and by such procedures. There is no warranty with respect to values of the materials at other locations.

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PRODUCT DESCRIPTION

AK Steel 410S Stainless Steel is a non-hardening modification of Type 410. A small aluminum addition minimizes austenite formation at high temperatures, thereby restricting the alloy's ability to harden. The result is a soft, ductile condition when the material is rapidly cooled from above the critical temperature. This non-hardening characteristic also retards formation of hardening cracks when the steel is welded. The alloy is completely ferritic in the annealed condition.

Composition

	%
Carbon	0.08 max.
Manganese	1.00 max.
Phosphorus	0.040 max.
Sulfur	0.030 max.
Silicon	1.00 max.
Chromium	11.5 - 14.50
Titanium	0.20 max.

Available Forms

AK Steel 410S is available in thicknesses from 0.015" to 0.100" (0.38 to 2.54 mm) in widths up to 48" (1219 mm). For other sizes, inquire.

Metric Practice

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. Conversion to the metric system, known as the International System of Units (SI) has been accomplished in accordance with ASTM E380.

The newton (N) has been adopted by the SI as the metric standard unit of force. The term for force per unit of area (stress) is the newton per square meter (N/m²). Since this can be a large number, the prefix mega is used to indicate 1,000,000 units and the term meganewton per square meter (MN/m²) is used. The unit (N/m²) has been designated a pascal (Pa). The relationship between the U.S. and the SI units for stress is: 1000 pounds/in² = 1 kip/in² (ksi) = 6.8948 meganewtons/m² (MN/m²) = 6.8948 megapascals (MPa).

Mechanical Properties

Typical Mechanical Properties*

UTS ksi (MPa)	0.2% YS ksi (MPa)	Elongation % in 2" (50.8 mm)	Hardness Rockwell	Izod V-Notch ft-lbs (J)
65 (448)	40 (276)	25	B75	30 (42)

*Annealed - room temperature.

Physical Properties

Density, 0.28 lbs/in³
7.73 g/cm³

Electrical Resistivity, microhm-in (microhm-cm)
68°F (21°C) – 23.7 (60)

Specific Heat, BTU/lb/°F (kJ/kg•K)
32 - 212°F (0 - 100°C) – 0.11 (0.46)

Thermal Conductivity, BTU/hr/ft²/ft/°F (W/m•K)
212°F (100°C) – 15.6 (26.9)

Mean Coefficient of Thermal Expansion,
in/in/°F (µm/m•K)
32 - 212°F (0 - 100°C) – 6.0 x 10⁻⁶ (10.8)
32 - 600°F (0 - 315°C) – 6.4 x 10⁻⁶ (11.5)
32 - 1000°F (0 - 538°C) – 6.7 x 10⁻⁶ (12.2)
32 - 1200°F (0 - 649°C) – 7.5 x 10⁻⁶ (13.5)

Modulus of Elasticity, ksi (MPa)
29 x 10³ (200 x 10³)

Melting Range, °F (°C) – 2700 - 2790 (1482 - 1532)

Corrosion Resistance

The corrosion resistance of AK Steel 410S Stainless Steel is similar to Type 410. It provides adequate resistance to atmospheric corrosion, fresh water, mild acids and alkalies, and some other chemicals.

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Oxidation Resistance

The oxidation resistance of AK Steel 410S Stainless Steel is good. It can be used up to 1300°F (705°C) in continuous service. Scaling becomes excessive above about 1500°F (811°C) in intermittent service.

Formability

AK Steel 410S Stainless Steel can be easily formed by drawing, spinning, bending and roll forming.

Weldability

This ferritic class of stainless steels is generally considered to be weldable by the common fusion and resistance techniques. Special consideration is required to avoid brittle weld fractures during fabrication by minimizing discontinuities, maintaining low weld heat input, and occasionally warming the part somewhat before forming. This particular alloy is generally considered to have slightly poorer weldability than the most common alloy of the stainless class, Type 409. A major difference is addition of aluminum to control hardening, which results in the need for higher heat input to achieve penetration

during arc welding. When a weld filler is required, AWS E/ER 309L or 430 filler material is most often specified. Type 410S is well known in reference literature and can be obtained in the following ways:

1. ANSI/AWS A5.9, A5.222, and A5.4 (filler metals, minimum UTS and elongation).
2. "Welding of Stainless Steels and Other Joining Methods," SSINA, (800:982-0355).
3. "Welding AK Steel Stainless Steels," FDB #SF-71.

Heat Treatment

AK Steel 410S is not hardenable by heat treatment. It is annealed in the 1600 - 1650°F (871 - 899°C) range and then air cooled, mainly to relieve cold working strains. Care should be exercised to avoid exposure at temperatures of 2000°F (1093°C) or above because of possible embrittling effects. If excessively large grains are found after annealing mildly cold-worked material, the annealing temperature should be decreased to the 1200 - 1350°F (649 - 732°C) range.



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