



410S

STAINLESS STEEL

PRODUCT DATA BULLETIN



Moderate to Good Formability Good High-temperature Service

Slows Hardening Cracks When Welded

Minimal Hardenability

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. It has been widely used in chemical processing, including applications in distillation towers and separators.

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	(wt %)
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 – 0.135 in. (0.38 – 3.43 mm) in widths up to 48 in. (1219 mm). For other sizes, inquire.

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.

MECHANICAL PROPERTIES

TABLE 1 – TYPICAL MECHANICAL PROPERTIES

UTS ksi. (MPa)	0.2% YS ksi. (MPa)	Elongation % in 2" (50.8 mm)	Rockwell Hardness
67 (462)	41 (283)	27	B72

PHYSICAL PROPERTIES

TABLE 2 – PHYSICAL PROPERTIES

Density, lbs./in. ³ (g/cm ³)	0.28 (7.73)
Electrical Resistivity, $\mu\Omega\cdot\text{in.}$ ($\mu\Omega\cdot\text{cm}$) 68 °F (21 °C)	23.7 (60)
Specific Heat, BTU/lbs./°F (kJ/kg·K) 32 – 212 °F (0 – 100 °C)	0.11 (0.46)
Thermal Conductivity, BTU/hr./ft./°F (W/m·K) 212 °F (100 °C)	15.6 (26.9)
Mean Coefficient of Thermal Expansion, in./in./°F ($\mu\text{m/m}\cdot\text{K}$)	
32 – 212 °F (0 – 100 °C)	6.0×10^{-6} (10.8)
32 – 600 °F (0 – 315 °C)	6.4×10^{-6} (11.5)
32 – 1000 °F (0 – 538 °C)	6.7×10^{-6} (12.2)
32 – 1200 °F (0 – 649 °C)	7.5×10^{-6} (13.5)
Modulus of Elasticity, ksi. (MPa)	29.0×10^3 (200×10^3)
Melting Range, °F (°C)	2700 – 2790 (1482 – 1532)

CORROSION RESISTANCE

The corrosion behavior of AK Steel 410S Stainless Steel provides moderate resistance to atmospheric and neutral chloride corrosion. However, is not recommended for applications where surface appearance is critical as it is prone to localized pitting corrosion. In the as-welded condition this material may be susceptible to sensitization which can lead to preferential grain boundary attack in the heat affected zone. Like most 11 – 14% chromium alloys, in highly acidic environments this grade can undergo uniform corrosive attack that will result in high corrosion rates. Caution should be exercised when considering this alloy in environments of such extreme conditions.

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 is often used in applications requiring blanking, bending, roll forming and moderate drawing.

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, controlling 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, but better than standard non-stabilized 410 stainless with higher carbon. 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 needed, AWS Classification ER/EC430, E430TX-X, ER/EC309L, or E309LT0-3 wires may be used.

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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Headquartered in West Chester, Ohio, AK Steel is a world leader in the production of flat rolled carbon, stainless and electrical steel products, primarily for automotive, infrastructure and manufacturing, construction and electrical power generation and distribution markets. The company operates seven steel plants and two tube manufacturing plants across four states – Indiana, Kentucky, Ohio and Pennsylvania. All of the company's steel plants are ISO/TS 16949, ISO 9001 and ISO 14001 certified for their quality and environmental management systems. AK Steel is a publicly held company traded over the New York Stock Exchange under the symbol AKS – aligning the company with many of the most prominent corporations in America.

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