

410 Cb STAINLESS STEEL



AK Steel 410 Cb is an improved version of standard Type 410 that provides superior characteristics, yet costs no more. By the addition of columbium, properties are improved without altering any of the desirable characteristics of Type 410.

The alloy offers three major advantages over Type 410:

- 1) Greater ease in heat treating
- 2) Higher strength and toughness
- 3) Improved grain size control

When tempering Type 410, rapid changes in hardness can occur with relatively minor changes in time and temperature. For this reason, it is often difficult to obtain uniform, consistent hardness from part to part, especially when heat treating large furnace loads where temperature variations are more likely to exist. AK Steel 410 Cb alleviates that problem because it is not as sensitive to time and temperature variations. Specific hardness ranges can be maintained more consistently.

In the annealed condition, the mechanical properties of AK Steel 410 Cb are about the same as those of Type 410. However, after tempering, the alloy has appreciably higher strength and ductility than Type 410 at both elevated and sub-zero temperatures. Also, the impact strength of AK Steel 410 Cb is significantly higher than Type 410 in most heat-treated conditions.

AK Steel 410 Cb can replace 409 Ni in some flange applications. In addition, it can be used as a replacement wher-

ever Type 410 is specified. In a wide variety of applications that could include exhaust flanges, steam turbine blades, aerospace equipment and flat springs.

TYPICAL COMPOSITION

	%
Carbon	0.12
Manganese	0.19
Phosphorus	0.021
Sulfur	0.004
Silicon	0.24
Chromium	11.9
Columbium	0.15
Molybdenum	0.027

MECHANICAL PROPERTIES

Typical Mechanical Properties*

Tempering Temperature °F (°C)	UTS ksi (MPa)	0.2% YS ksi (MPa)	Elongation % in 2" (50.8 mm)	Hardness Rockwell	Charpy Impact V-Notch ft-lbs (J)
500 (260)	181 (1248)	150 (1034)	15	C32	27 (38)
700 (371)	177 (1220)	149 (1027)	14.5	C36	24 (34)
900 (482)	187 (1289)	144 (993)	17	C35	18 (25)
1000 (538)	176 (1213)	134 (924)	14	C33	8 (11)
1100 (593)	132 (910)	116 (800)	17	C26	19 (27)
1200 (649)	123 (848)	105 (724)	18	C24	33 (47)
1300 (704)	111 (765)	92 (634)	20	B89	41 (58)
1400 (760)	95 (655)	73 (503)	26	B92	78 (110)

* Hardened at 1850°F (1010°C) for 30 minutes, oil quenched plus tempered for 4 hours at temperature shown. Data a product of one plant-processed heat. 3/8" (9.5mm) plate, transverse direction.

AVAILABLE FORMS

AK Steel 410 Cb is available in 0.0250" to 0.375" (0.64 to 9.5 mm) thick strip. For other sizes, inquire.

PHYSICAL PROPERTIES

Density, 0.28 (7.73) lbs/in³ (g/cm³)

Electrical Resistivity,
22.5 (57) microhm-in (microhm-cm)

Thermal Conductivity,
BTU/hr/ft²/ft/°F (W/m•K)
212°F (100°C) 14.4 (24.8)
932°F (500°C) 16.6 (28.6)

Mean Coefficient of Thermal Expansion
in/in/°F (µm/m•K)

32 - 212°F (0 - 100°C) 5.5×10^{-6} (9.9)
32 - 1200°F (0 - 649°C) 6.5×10^{-6} (11.6)

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

CORROSION RESISTANCE

The corrosion resistance of AK Steel 410 Cb Stainless Steel is the same as Type 410 as demonstrated in laboratory tests and actual service.

The tempering characteristics of AK Steel 410 Cb offer an advantage over Type 410 in resistance to stress corrosion cracking. To develop similar tensile strengths, a higher tempering temperature is used with AK Steel 410 Cb. The higher temperature results in more effective relief of residual internal stresses that, in some environments, promote stress corrosion cracking.

FABRICATION

AK Steel 410 Cb Stainless Steel can be fabricated using the same procedures for Type 410 of similar hardness or strength.

WELDABILITY

The martensitic class of stainless steels has limited weldability due to its hardenability. It is usually not necessary to preheat this alloy to avoid cold cracking. Post-weld heat treatment could be considered to achieve optimum

properties. This particular alloy is generally considered to have equivalent weldability to the most common alloy of this stainless class, Type 410. A major difference is the columbium addition for this alloy, which improves properties without affecting the weldability. When a weld filler is needed, AWS E/ER 410, 410 NiMo, and 309L are most often specified. AWS E/ER 409 is often used for attachment welds in automotive exhaust systems. Type 410 is well known in reference literature and more information can be obtained in this way.

HEAT TREATMENT

Hardening temperatures for AK Steel 410 Cb are in the same general range as those used for Type 410. However, higher tempering temperatures are required to obtain the same hardness in AK Steel 410 Cb. Due to the higher tempering temperatures, more internal stresses are removed, resulting in better ductility.

When tempering Type 410, temperatures must be held within a narrow range to achieve a specific hardness. Variations in either temperature or time cause the hardness to vary, resulting in costly re-treatments or rejects. Also, parts must be racked carefully in the furnace to assure uniform heating throughout the charge.

With AK Steel 410 Cb, the allowable temperature range for tempering to achieve a specific hardness is almost twice that for Type 410. Because temperature variation and time are much less critical than for Type 410, re-treatments are virtually eliminated. In addition, parts made of AK Steel 410 Cb can be batched or stacked instead of racked in the furnace. This procedure not only permits larger furnace loads, but also reduces costly hand labor needed for racking.

METRIC CONVERSION

Data in this publication are presented in U.S. customary units. Approximate metric equivalents may be obtained by performing the following calculations: Length (inches to millimeters) – Multiply by 25.4

Strength (ksi to megapascals or meganewtons per square meter) – Multiply by 6.8948

Temperature (Fahrenheit to Celsius) – (°Fahrenheit - 32) - Multiply by 0.5556

Density (pounds per cubic inch to kilograms per cubic meter) – Multiply by 27,670

The information and data in this product data bulletin are accurate to the best of our knowledge and belief, but are intended for general information only. Applications suggested for the materials are described only to help readers make their own evaluations and decisions, and are neither guarantees nor to be construed as express or implied warranties of suitability for these or other applications.

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.

This document or any part therein may not be reproduced without the written permission of AK Steel Corporation. AK Steel and the AK Steel logo are registered trademarks of AK Steel Corporation.



Customer Service 800-331-5050

AK Steel Corporation
9227 Centre Pointe Drive
West Chester, OH 45069

www.aksteel.com