

# 304/304L

## STAINLESS STEEL

UNS S30400/UNS S30403



AK Steel Type 304 is a variation of the basic 18-8 grade, Type 302, with a higher chromium and lower carbon content. Lower carbon minimizes chromium carbide precipitation due to welding and its susceptibility to intergranular corrosion. In many instances, it can be used in the "as-welded" condition, while Type 302 must be annealed in order to retain adequate corrosion resistance.

Type 304L is an extra low-carbon variation of Type 304 with a 0.03% maximum carbon content that eliminates carbide precipitation due to welding. As a result, this alloy can be used in the "as-welded" condition, even in severe corrosive conditions. It often eliminates the necessity of annealing weldments except for applications specifying stress relief. It has slightly lower mechanical properties than Type 304.

Typical uses include architectural moldings and trim, kitchen equipment, welded components of chemical, textile, paper, pharmaceutical and chemical industry processing equipment.

### AVAILABLE FORMS

AK Steel produces Type 304 Stainless Steel in thicknesses from 0.01" to 0.25" (0.025 to 6.35 mm) max. and widths up to 48" (1219 mm). For other thicknesses and widths, inquire.

### COMPOSITION

|            | Type 304<br>% | Type 304L<br>% |
|------------|---------------|----------------|
| Carbon     | 0.08 max.     | 0.03 max.      |
| Manganese  | 2.00 max.     | 2.00 max.      |
| Phosphorus | 0.045 max.    | 0.045 max.     |
| Sulfur     | 0.030 max.    | 0.030 max.     |
| Silicon    | 0.75 max.     | 0.75 max.      |
| Chromium   | 18.00-20.00   | 18.0-20.0      |
| Nickel     | 8.00-12.00    | 8.0-12.0       |
| Nitrogen   | 0.10 max.     | 0.10 max.      |
| Iron       | Balance       | Balance        |

### SPECIFICATIONS

AK Steel Types 304 and 304L Stainless Steels are covered by the following specifications:

| Type 304   | Type 304L  |
|------------|------------|
| AMS 5513   | AMS 5511   |
| ASTM A 240 | ASTM A 240 |
| ASTM A 666 | ASTM A 666 |

### MECHANICAL PROPERTIES

Typical Room Temperature Mechanical Properties

|           | UTS<br>ksi (MPa) | 0.2% YS<br>ksi (MPa) | Elongation<br>% in 2"<br>(50.8 mm) | Hardness<br>Rockwell |
|-----------|------------------|----------------------|------------------------------------|----------------------|
| Type 304L | 85 (586)         | 35 (241)             | 55                                 | B80                  |
| Type 304  | 90 (621)         | 42 (290)             | 55                                 | B82                  |

**PHYSICAL PROPERTIES**

Density, 0.29 lbs/in<sup>3</sup>  
8.03 g/cm<sup>3</sup>

Electrical Resistivity, microhm-in  
(microhm-cm)  
68°F (20°C) – 28.4 (72)  
1200°F (659°C) – 45.8 (116)

Specific Heat, BTU/lb/°F (kJ/kg•K)  
32 - 212°F (0 - 100°C) – 0.12 (0.50)

Thermal Conductivity, BTU/hr/ft<sup>2</sup>/ft/°F  
(W/m•K)  
at 212°F (100°C) – 9.4 (16.2)  
at 932°F (500°C) – 12.4 (21.4)

Mean Coefficient of Thermal Expansion,  
in/in/°F (µm/m•K)  
32- 212°F (0 - 100°C) – 9.4 x 10<sup>-6</sup>(16.9)  
32- 600°F (0 - 315°C) – 9.6 x 10<sup>-6</sup>(17.3)  
32-1000°F (0 - 538°C) –10.2 x 10<sup>-6</sup>(18.4)  
32-1200°F (0 - 649°C) –10.4 x 10<sup>-6</sup>(18.7)

Magnetic Permeability, H = 200  
Oersteds, Annealed - 1.02 max.

Modulus of Elasticity, ksi (MPa)  
28.0 x 10<sup>3</sup> (193 x 10<sup>3</sup>) in tension  
11.2 x 10<sup>3</sup> ( 78 x 10<sup>3</sup>) in torsion

Melting Range, °F (°C) – 2550 - 2650  
(1399 - 1454)

**CORROSION RESISTANCE**

These steels exhibit excellent resistance to a wide range of atmospheric, chemical, textile, petroleum and food industry exposures.

**OXIDATION RESISTANCE**

The maximum temperature to which Types 304 and 304L can be exposed continuously without appreciable scaling is about 1650°F (899°C). For intermittent exposure, the maximum exposure temperature is about 1500°F (816°C).

**HEAT TREATMENTS**

Type 304 is non-hardenable by heat treatment. Annealing: Heat to 1900 - 2050°F (1038 - 1121°C), then cool rapidly. Thin strip sections may be air cooled, but heavy sections should be water quenched to minimize exposure in the carbide precipitation region.

Stress Relief Annealing: Cold worked parts should be stress relieved at 750°F (399°C) for 1/2 to 2 hours.

**FORMABILITY**

Types 304 and 304L have very good drawability. Their combination of low yield strength and high elongation permits successful forming of complex shapes. However, these grades work harden rapidly. To relieve stresses produced in severe forming or spinning, parts should be full annealed or stress-relief annealed as soon as possible after forming.

**WELDABILITY**

The austenitic class of stainless steels is generally considered to be weldable by the common fusion and resistance

techniques. Special consideration is required to avoid weld "hot cracking" by assuring formation of ferrite in the weld deposit. Types 304 and 304L are generally considered to be the most common alloys of this stainless class. When a weld filler is needed, AWS E/ER 308, 308L or 347 are most often specified. Types 304 and 304L Stainless Steels are well known in reference literature and more information can be obtained in this way.

**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

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Data referring to mechanical properties and chemical analyses are the result of tests performed on specimens obtained from specific locations 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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