P R O D U C T D A T A S H E E T

321 STAINLESS STEEL

UNS S32100

AK Steel

Type 321 is a stabilized austenitic stainless steel similar to Type 304 but with a titanium addition of at least five times the carbon content. This titanium addition reduces or prevents carbide precipitation during welding and in 800 - 1500°F (427 - 816°C) service. It also improves the elevated temperature properties of the alloy.

Type 321 provides excellent resistance to oxidation and corrosion and possesses good creep strength. It is used primarily in applications involving continuous and intermittent service temperatures within the carbide precipitation range of 800 - 1500°F (427 - 816°C).

Applications include annealing covers, high-temperature tempering equipment, diesel and heavy duty automotive exhaust systems, firewalls, stack liners, boiler casings, welded pressure vessels, jet aircraft components, radiant superheaters, bellows and oil refinery equipment.

COMPOSITION

	%
Carbon	0.08 max.
Manganese	2.00 max.
Phosphorus	0.045 max.
Sulfur	0.030 max.
Silicon	0.75 max.
Chromium	17.00-19.00
Nickel	9.00-12.00
Titanium	5 x (C + N) min., 0.70 max.
Nitrogen	0.10 max.
Iron	Balance

AVAILABLE FORMS

AK Steel produces Type 321 Stainless Steel in thicknesses from 0.01" to 0.25" (0.25 to 6.35 mm) max. and widths up to 48" (1219 mm). For other thicknesses and widths, inquire.

SPECIFICATIONS

Type 321 Stainless Steel is covered by the following specifications:

AMS 5510
ASTM A 240
MIL-S-6721

PHYSICAL PROPERTIES

Density, 0.29 lbs/in^3
9.01 g/cm^3

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

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

Thermal Conductivity, BTU/hr/ft^2/ft/°F (W/m•K)
at 212°F (100°C) – 9.3 (16.0)
at 932°F (500°C) – 12.8 (22.0)

MECHANICAL PROPERTIES

Typical Room Temperature Properties

UTS ksi (MPa)	0.2% YS ksi (MPa)	Elongation % in 2" (50.8 mm)	Hardness Rockwell
90 (621)	40 (276)	45	B80

Coefficient of Thermal Expansion, in/in/°F(μm/m•K)
32 - 212°F (0 - 100°C) – 9.2 x 10^{-6} (16.6)
32 - 600°F (0 - 315°C) – 9.5 x 10^{-6} (17.1)
32 -1000°F (0 - 538°C) – 10.3 x 10^{-6} (18.5)
32 -1200°F (0 - 649°C) – 10.7 x 10^{-6} (19.3)
32 -1500°F (0 - 871°C) – 11.2 x 10^{-6} (20.2)

Modulus of Elasticity, ksi (MPa)
28.0 x 10^3 (193 x 10^3) in tension
11.2 x 10^3 (78 x 10^3) in torsion

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

Melting Range,°F (°C) – 2500 - 2550 (1371 - 1399)

CORROSION RESISTANCE

Type 321 exhibits excellent resistance to organic chemicals, dyestuffs, and a wide range of inorganic chemicals. It resists nitric acid well and the sulfur acids moderately. Long-time exposure in the 900 - 1500°F (482 - 816°C) range may lower its general corrosion resistance, but the grade still shows improved resistance to intergranular corrosion compared to unstabilized grades.

HEAT TREATMENTS

Type 321 is non-hardenable by heat treatment.

Annealing: Heat to 1750 - 2050°F (954 - 1121°C), then water quench or air cool.

FORMABILITY

Type 321 can be readily formed and drawn. However, higher pressures are required than for carbon steel, and more springback is encountered than when forming regular sheet steel. Like most other austenitic stainless steels, Type 321 work hardens and may require annealing after severe 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. This particular alloy is generally considered to have comparable weldability to Types 304 and 304L. A major difference is the titanium addition that reduces or prevents carbide precipitation during welding. When a weld filler is needed, either AWS E/ER 347 or E/ER 321 is most often specified. Type 321 is 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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Stainless Steel The Value Option

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