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Ulbrich Stainless Steels & Special Metals, Inc. • 153 Washington Avenue • North Haven, CT 06473 USA • 800-243-1676 • ULBRICH.com

316 STAINLESS STEEL, UNS S31600

Strip, Coil, Foil, Wire, ASTM A666, AMS5524

Applications

Pulp and Paper Equipment, Heat exchangers, Propeller shafts, Fittings, Dyeing Equipment, Exterior Architectural components in Marine Coastal Areas

Description

Type 316 (UNS 31600) is an austenitic chromium-nickel stainless steel containing molybdenum. This addition increases corrosion resistance, improves resistance to pitting chloride ion solutions and provides increased strength at elevated temperatures. Properties are similar to those of type 304 except that type 316 is somewhat stronger at elevated temperatures. Corrosion resistance is improved, particularly against sulfuric, hydrochloric, acetic, formic and tartaric acids, acid sulfates and alkaline chlorides.

Chemistry Typical

Carbon: 0.08 max
Manganese: 2.00 max
Silicon: 1.00 max
Chromium: 16.00-18.00
Nickel: 10.00-14.00
Molybdenum: 2.00-3.00
Phosphorus 0.040
Sulfur: 0.030 max
Copper: 0.75 max
Iron: Balance

Physical Properties

Density: 0.29 lbs/in³ 7.99 g/cm³

Electrical Resistivity: microhm-in (microhm-cm): 68 °F (20 °C): 29.4 (74.0)

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

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Thermal Conductivity: BTU/hr/ft²/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): 8.9×10^{-6} (16.0)

32 - 600 °F (0 – 315 °C): 9.0×10^{-6} (16.2)

32 - 1000 °F (0 – 538 °C): 9.7×10^{-6} (17.5)

32 - 1200 °F (0 – 649 °C): 10.3×10^{-6} (18.5)

32 - 1500 °F (0 – 871 °C): 11.1×10^{-6} (18.5)

Modulus of Elasticity: ksi (MPa)

28×10^3 (193×10^3) in tension

11.2×10^3 (77×10^3) in torsion

Magnetic Permeability: H = 200 Oersteds: Annealed < 1.02 max

Melting Range: 2500 - 2590 °F (1371 - 1421 °C)

Forms

Coil – Strip, Foil, Ribbon

Wire – Profile, Round, Flat, Square

Mechanical Properties at Room Temperature

Properties: Typical

Ultimate Tensile Strength: 75 KSI min (515 MPa min)

Yield Strength (0.2% Offset): 30 KSI min (205 MPa min)

Elongation: 40% min

Hardness: Rb 95 max

Properties: Tempered

1/16 Hard

Ultimate Tensile Strength: 85 KSI min (585 MPa min)

Yield Strength: (0.2% Offset) 45 KSI min (310 MPa min)

Elongation: 35% Min

1/8 Hard

Ultimate Tensile Strength: 100 KSI min (690 MPa min)

Yield Strength: (0.2% Offset) 55 KSI min (380 MPa min)

Elongation: 25% Min

1/4 Hard

Ultimate Tensile Strength: 125 KSI min (860 MPa min)

Yield Strength: (0.2% Offset) 75 KSI min (515 MPa min)

Elongation: 10% Min

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Tempered:

Type 316 can be rolled to achieve the temper properties required by specific customers and/or manufacturing requirements. For tempers 1/2 hard or above consult Ulbrich Technical Services for more information.

Additional Properties**Corrosion Resistance**

Refer to NACE (National Association of Corrosion Engineers) for recommendations.

Finishes

1 – Hot rolled annealed and descaled. It is available in strip, foil and ribbon. It is used for applications where a smooth decorative finish is not required.

2D – Dull finish produced by cold rolling, annealing and descaling. Used for deep drawn parts and those parts that need to retain lubricants in the forming process.

2B – Smooth finish produced by cold rolling, annealing and descaling. A light cold rolling pass is added after anneal with polished rolls giving it a brighter finish than 2D.

#BA – Bright annealed cold rolled and bright annealed

#CBA – Course bright annealed cold rolled matte finish and bright anneal

#2 – Cold Rolled

2BA – Smooth finish produced by cold rolling and bright annealing. A light pass using highly polished rolls produces a glossy finish. A 2BA finish may be used for lightly formed applications where a glossy finish is desired in the formed part.

Polished – Various grit finish for specific polish finished requirements.

** Not all finishes are available in all alloys – Contact Ulbrich Sales for more information.*

Wire Finishes

XC – Extra clean bright annealed or bright annealed and cold rolled

Grease – Ultra-bright finish (for decorative applications)

Soap – Soap is not removed from tempered wire to act as a lubricant.

** Contact Ulbrich Wire for custom wire finishes.*

Cold Forming

Type 316 can be readily formed and drawn.

Heat Treatment

Type 316 is non hardenable by heat treatment.

Welding

Type 316 is weldable by common fusion and resistance methods. It can develop intergranular corrosion in the welded areas due to the high carbon content.

For best results refer to: SSINA's "Welding of Stainless Steels and Other Joining Methods".

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