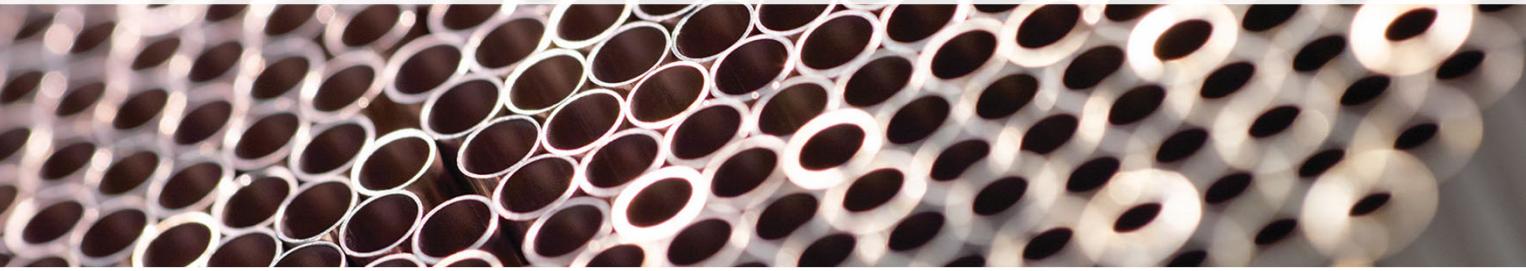


# 316/316L Stainless Steel



## General Description

Type 316/316L stainless steel, with its chromium-nickel and low carbon content, is a commonly used austenitic stainless steel. This alloy has similar physical properties and fabrication characteristics as Type 304. The addition of molybdenum (versus 304) increases the corrosion resistance in saltwater applications. The biocompatibility of this alloy has been well researched. This grade of stainless is an economical option and typically readily available. The lower carbon content in 316L grade increases resistance to intergranular corrosion following welding or stress relieving.

## Applications

- Suture wire
- Screws / prostheses / plates
- Orthopedic cables
- Skin Closure staples
- Stylets
- Catheters
- Bone pins

## Reference Standards

- AMS 5573
- ASTM A632
- Mil-T 8504
- ASTM A269
- ASTM F899

## Characteristics

- Cold working will achieve higher tensile strengths as well as leaving the material slightly magnetic.
- Annealing will result in little to no magnetism—perfect for operating room or implants within the body.
- The properties can easily be manipulated to allow for forming of complex shapes.
- Economical and readily available stainless steel
- Better general corrosion resistance than 304 stainless
- 316L grade increases resistance to intergranular corrosion following welding.

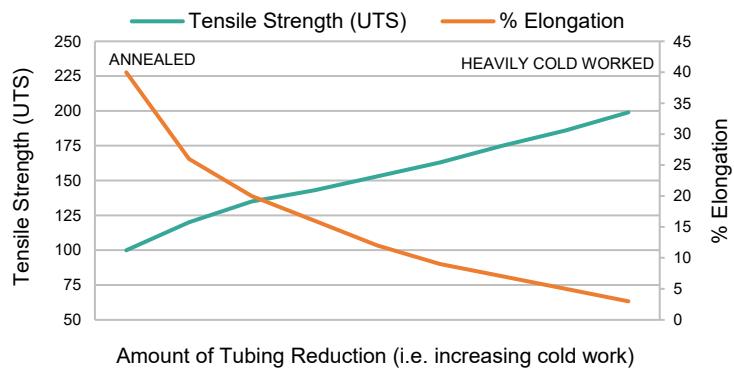
## Typical Chemistry

Element	Minimum	Maximum
Carbon		0.08%*
Manganese		2.00%
Phosphorous		0.045%
Sulfur		0.03%
Silicon		0.75%
Chromium	16.00%	18.00%
Nickel	10.00%	14.00%
Molybdenum	2.0%	3.0%
Nitrogen		0.10%

\*316L has a lower carbon content of .03% max

## Possible Mechanical Properties

Attribute	Annealed	Typical As Drawn
Hardness	82 HRB	38 HRC
Tensile Strength	100 ksi	160 ksi
Elongation	40%	7%



## General Properties

Attribute	English
Density	.289 lb/in³
Elastic modulus	28000 ksi
Shear modulus	11200 ksi
Mean specific heat (32-212F)	.120 Btu/lb/F
Thermal conductivity (32-212F)	112 BTU-in/hr-ft² - F
Mean CTE (32-1200F)	10.4x10-6 in/in/F
Electrical resistivity (68F)	74 microohm-cm
Magnetic Permeability (Annealed)	1.008

## Tubing-specific Requirements

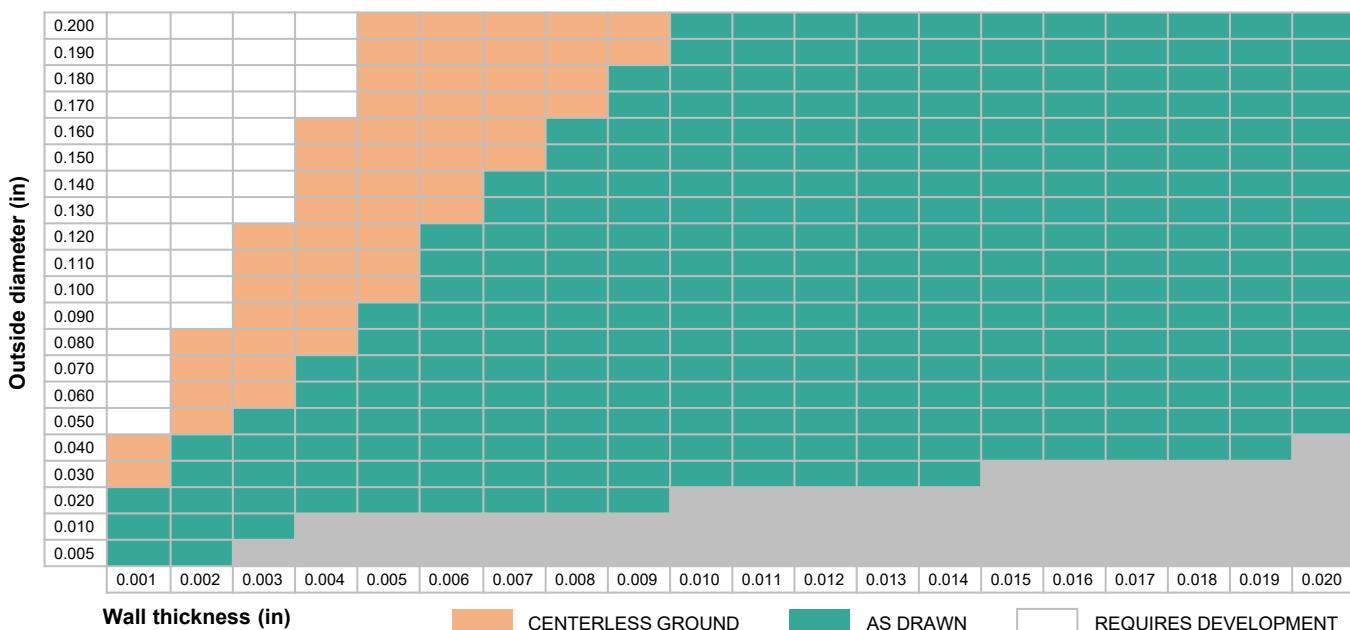
- Lengths:** Tubing is normally furnished in mill lengths of 5 ft, but it can be supplied in up to 20 ft lengths with a shear cut end.
- Cut End Finish:** Precision cut-to-length pieces with burr-free ends can be furnished when specified.
- Roundness:** Difference in minimum and maximum OD measurements must be equal or less than half the OD tolerance.
- Surface Finish:** OD and ID surface finish (Rq or RMS) limits may be specified. ID and OD surface finish values are only reported for dimensions  $>0.020$ ".

- Typical OD Surface:**  $< 20$   $\mu\text{in}$  Rq.
- ID Surface finish:** Depends on the reduction (drawing) method. Free sunk tubing has a typical ID surface finish  $<150$   $\mu\text{in}$  Rq. Plug drawn tubing can have an ID surface finish range with values as low as  $< 20$   $\mu\text{in}$  Rq.
- Straightness:** No deflection greater than 5% of the outside diameter for tubing with OD  $> 0.020$ " or  $0.001$ " maximum deflection for tubing with OD  $<0.020$ ". Any special straightness requirements shall be agreed upon between the purchaser and supplier. Tubing should not "wobble" as defined per ASTM F2819

Additional tubing specification information can be found in *K001-15a Standard Specification for Miniature Laser Welded and Drawn Stainless Steel and Nickel-Chromium Alloy Tubing for General Use* on the K-Tube's website at <https://www.k-tube.com/downloads-documents/>

## Available Dimensions

K-Tube has the capability to make tubing with the wall thickness and outside diameter combinations in the table below. Tubing with an OD/Wall ratio lower than 20:1 can be drawn to the final dimensions. Tubing with an OD/Wall ratio between 20:1 and 40:1 must be centerless ground to the final dimensions. K-Tube's capabilities are constantly improving, please inquire if your dimensions are outside of the listed dimensions.



## Contact Information

Our professional staff is available to assist you with custom projects and provide you with the direction you need to complete your project to specification and on time. We look forward to working with you.

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Poway, CA 92064 USA

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**Local** | 858.513.9229  
**Fax** | 858.513.9459

**Hours** | 7:00 am-4:30 pm (PST)  
**General questions and inside sales** | [sales@k-tube.com](mailto:sales@k-tube.com)



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