Stainless Steel 316L

MATERIAL DATA SHEET

Stainless Steel 316L is a corrosion resistant iron based alloy characterized having a good corrosion resistance and evidence that there are no leach-able substances in cytotoxic concentrations. This material is ideal in:

- Lifestyle/Consumer - watches, other jewelery, spectacle frames, decorations, functional elements in electronic housing and accessories
- Automotive/Industrial – non-corroding common material, food and chemical plants
- Aerospace/Turbine industry – entry-level material for Laser Sintering Technology, mounting parts, brackets, heat exchanger

Parts built from Stainless Steel 316L can be machined, shot-peened and polished in as-built or stress relieved (AMS2759) states if required. Solution annealing is not necessary because the mechanical properties of as-built state are showing desired values (ASTMA403). Parts are not ideal in temperature range 427 °C - 816 °C where precipitation of chromium carbides occurs. Due to layer-wise building method, the parts have a certain anisotropy which could be seen from mechanical properties.

General process data

Typical achievable part accuracy [1] *- small parts*	approx. ± 20-50 µm (± 0.0008 – 0.002 inch)
- large parts	approx. ± 0.2 %
Minimum wall thickness [2]	approx. 0.3 - 0.4 mm (0.012 – 0.016 inch)
Layer thickness	20 µm (0.8 x 10^{-3} inch)
Surface roughness [3] *- as manufactured*	Ra 13 ± 5 µm; Rz 80 ± 20 µm Ra 0.5 ± 0.2 x 10^{-3} inch; Rz 3.1 ± 0.8 x 10^{-3} inch
- after shot-peening	Ra 5 ± 2 µm; Rz 30 ± 10µm Ra 0.2 ± 0.08 x 10^{-3} inch; Rz 1.2 ±0.4 x 10^{-3} inch
- after polishing	Rz up to < 0.5 µm *Rz up to < 0.04 x 10^{-3} inch* *(can be very finely polished)*
Volume rate [4]	2 mm^3/s (7.2 cm^3/h) 0.44 in^3/h

BAKER INDUSTRIES

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Physical & chemical properties of parts

Material composition	Fe (Balance)	C (≤ 0.030%)	S (≤ 0.010%)
	Cr (17 - 19%)	Mn (≤ 2.0%)	Si (≤ 0.75%)
	Ni (13 - 15%)	Cu (≤ 0.50%)	N (≤ 0.10%)
	Mo (2.25 - 3%)	P (≤ 0.025%)	
Relative density	approx. 100 %		
Density	min. 7.9 g/cm^3		
	min. 0.285 lb/in^3		

Mechanical properties of parts at room temp. - as built

	Horizontal Axis (XY)	*Vertical Axis (Z)*
Ultimate tensile strength [5]	640 ± 50 MPa	540 ± 55 MPa
Yield strength (Rp 0.2 %) [5]	530 ± 60 MPa	470 ± 90 MPa
Young's modulus [5]	typ. 185 GPa	typ. 180 GPa
Elongation at break [5]	40 ± 15%	50 ± 20%
Hardness [6]	typ. 85 HRB	

[1] Based on users' experience of dimensional accuracy for typical geometries, e.g. ± 40 µm (0.0016 inch) when parameters can be optimized for a certain class of parts or ± 60 µm (0.0024 inch) when building a new kind of geometry for the first time. Part accuracy is subject to appropriate data preparation and post-processing.

[2] Mechanical stability is dependent on geometry (wall height etc.) and application.

[3] Due to the layer-wise building, the surface structure depends strongly on the orientation of the surface, for example sloping and curved surfaces exhibit a stair-step effect. The values also depend on the measurement method used. The values quoted here given an indication of what can be expected for vertical surfaces.

[4] Volume rate is a measure of build speed during laser exposure. The total build speed depends on the average volume rate, the re-coating time (related to the number of layers) and other factors such as contour and Up-Down Skin parameters.

[5] Machining and testing of the test bars according to ISO 6892 / ASTM E8M, proportional test pieces, diameter of the neck area 5 mm (0.2 inch), gauge length 4D = 20.0mm (0.79 inch), stress rate 10MPa/s, strain speed in plastic region 0.375 1/min.

[6] Rockwell hardness (HRB) measurement according to EN ISO 6508-1 on polished surface.