

## Stainless Steel 316L

### General

The 316L alloy is an austenitic stainless steel that is molybdenum alloyed for improved performance in corrosive environments. The main characteristics of the 316L alloy is its high ductility, high strength and high corrosion resistance. This is a standard material for applications in tooling, mining, oil and gas and other industries. Laser powder bed fusion allows the material properties of parts produced to be precisely targeted.

### Material Structure

The 316L alloy is similar in chemistry to EN 1.4404 and UNS S316603 which is designed for processing in laser powder bed fusion additive manufacturing machines.

Powder chemical composition (wt. -%)		Powder particle size & shape	
Element	Nominal	Generic distribution	15 – 45 µm
Fe	Balance	Particle shape	Spherical
Cr	17		
Ni	13		
Mo	2		
Mn	< 1.0		
C	< 0.03		
Other	< 1.0		

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### Process Information

System Set-up	
System	RMP-1 Beta
Quantity of lasers	4
Parameter	APS-006
Laser power <sup>1</sup>	1.5 kW
Layer thickness	50 μm

Build Rate	
Theoretical melting rate bulk per laser <sup>2</sup>	54 cm <sup>3</sup> /h

### Chemical and Physical Properties of Parts

Part chemical composition <sup>3</sup> (wt. -%)	
Element	Nominal
Fe	Balance
Cr	17
Ni	13
Mo	3
Mn	< 1.0
C	< 0.03
Other	< 1.0

Physical Properties	
Average density <sup>4</sup>	≥ 7.95 g/cm <sup>3</sup>
Relative density	≥ 99.5 %

<sup>1</sup> Output laser power from each laser, the total laser power is equal to 6 kW

<sup>2</sup> Calculated (layer thickness x scan velocity x hatch distance)

<sup>3</sup> Performed by NATA accredited laboratory according to ASTM A751

<sup>4</sup> Density determination of test specimens according to ASTM B962

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### Mechanical Properties of Parts as built

Mechanical Properties		
	<i>Horizontal</i>	<i>Vertical</i>
<b>Offset Yield Strength<sup>5</sup> [MPa]</b>	538 ± 7	455 ± 6
<b>Upper Tensile Strength<sup>5</sup> [MPa]</b>	658 ± 6	564 ± 3
<b>Elongation at break<sup>5</sup> [%]</b>	37 ± 2	47 ± 2
<b>Young's Modulus<sup>5</sup> [GPa]</b>	177 ± 26	205 ± 18
<b>Reduction of Area<sup>5</sup> [%]</b>	65 ± 2	75 ± 5
<b>Vickers hardness<sup>6</sup> [HV10]</b>	216 ± 6	

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<sup>5</sup> Tensile testing according to ASTM E8 performed by a NATA accredited laboratory

<sup>6</sup> Hardness testing according to ASTM E92-17 performed by internal laboratory