Material
Data Sheet

EOS Stainless-Steel 316L

High performance marine-grade stainless steel

ECOPARTS
ADDITIVE METAL SOLUTIONS

EOS StainlessSteel 316L

EOS StainlessSteel 316L is a high performance marine-grade austenitic stainless steel that is molybdenum alloyed for enhanced corrosion resistance in chloride environments. 316L is a standard material for numerous applications in process, energy, paper, transportation and other industries. EOS StainlessSteel 316L is a stainless steel powder intended for manufacturing parts on EOS metal systems with EOS DMLS processes.

Main Characteristics:

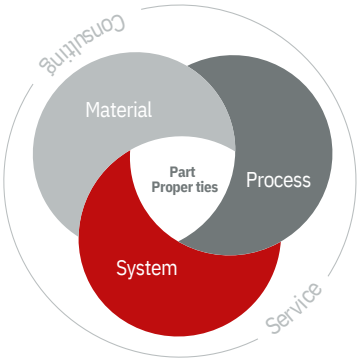
- High ductility and toughness
- High strength
- High corrosion resistance

Typical Applications:

- Chemical industry
- Food processing
- Medical devices

The EOS Quality Triangle

EOS uses an approach that is unique in the AM industry, taking each of the three central technical elements of the production process into account: the system, the material and the process – together simply described as the Quality Triangle. EOS focuses on delivering reproducible part properties for the customer.



All of the data stated in this material data sheet is produced according to EOS Quality Management System and international standards.

Powder Properties

The chemical composition of EOS StainlessSteel 316L corresponds to ASTM F138 material standard for Surgical Implants (UNS S31673).

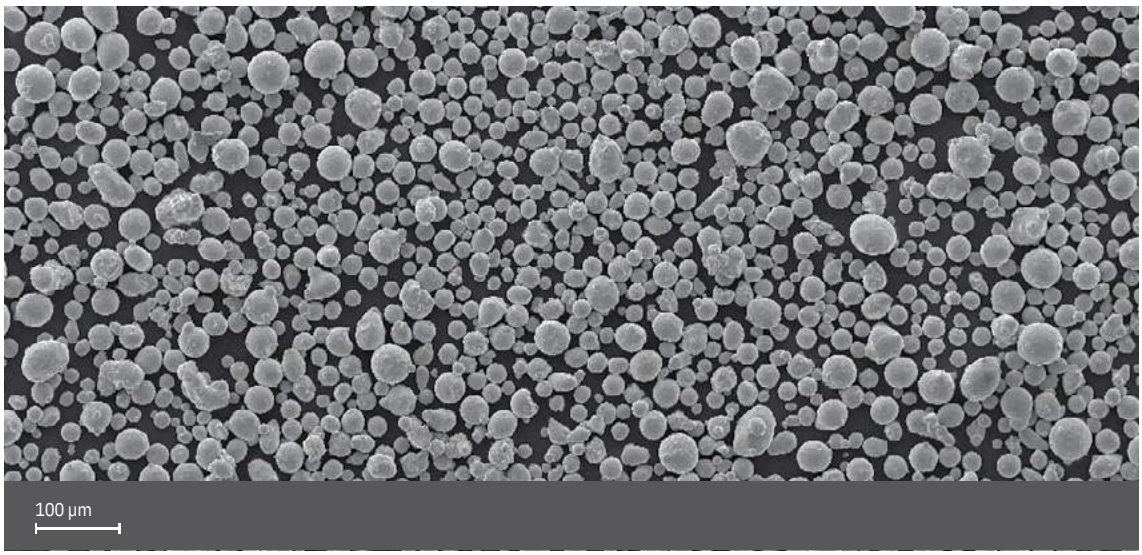
Powder chemical composition (wt.-%)

Element	Min.	Max.
Fe	Balance	
Cr	17. 0 0	19.00
Ni	13.00	15.00
Mo	2.25	3.00
C	-	0.03
N	-	0.10

Powder particle size

Generic particle size distribution	20 – 65 µm

SEM picture of
EOS StainlessSteel 316L powder.

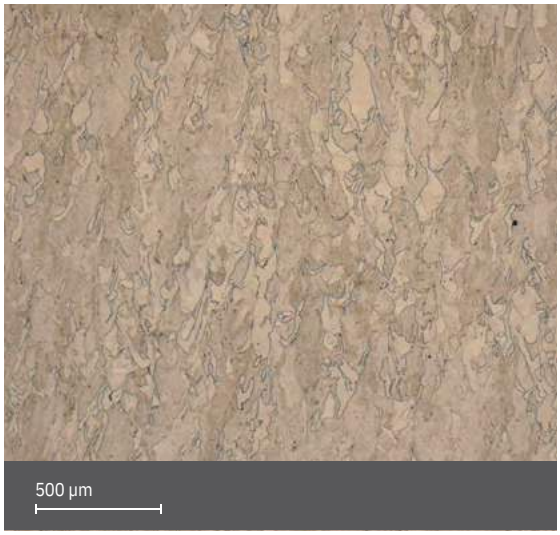


Heat Treatment

Stress relieve: Hold temperature 900 C, hold time minimum 2 h when throughly heated, water quenching or high speed gas quenching. Cooling rate to be high enough to prevent chromium carbide precipitation.

Solution annealing: Hold temperature 1150 C, hold time minimum 1,5 h when throughly heated, water quenching or high speed gas quenching. Cooling rate to be high enough to prevent chromium carbide precipitation.

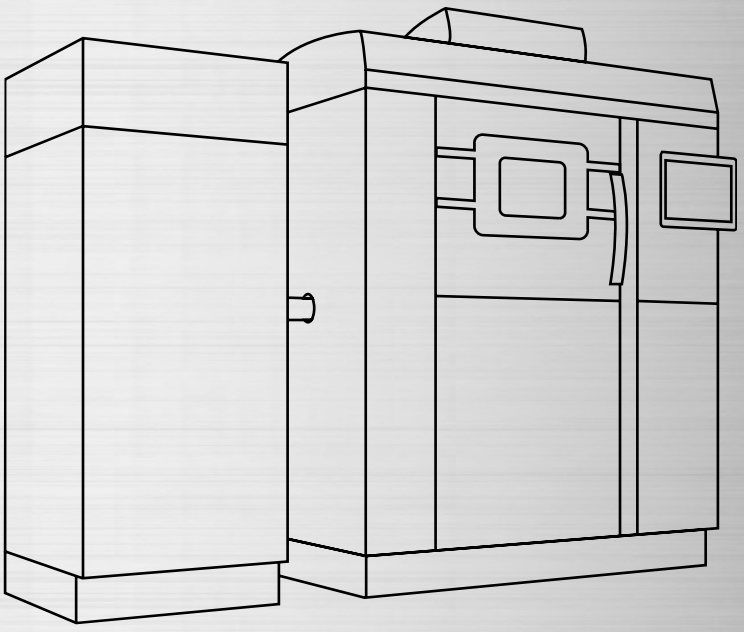
Microstructure solution annealed
Etched with etchant Kallings 2



Coefficient of Thermal Expansion ASTM E228

Temperature	25-100 °C	25-200 °C	25-300 °C	25-400 °C
CTE	15.72 *10-6/K	16.75 *10-6/K	17.27 *10-6/K	17.70 *10-6/K

TRL 9
Premium



EOS StainlessSteel 316L
for EOS M 290 | 20 µm

Process Information
Chemical and Physical Part Properties
Heat Treatment
Mechanical Properties
Additional Data

HHE/05.2014

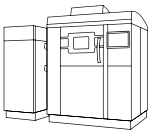
EOS StainlessSteel 316L for EOS M 290 | 20 µm
Process Information

This process product is optimized for robustly building parts with EOS M290 system using EOS StainlessSteel 316L. The mechanical properties have been validated to TRL9 level.

System set-up	EOS M 290
EOSPAR name	316L_Surface
Software requirements	EOSPRINT 2.7 or newer EOSYSTEM 2.11 or newer
Powder part no.	9 011- 0 0 32
Recoater blade	EOS HSS blade
Nozzle	Standard nozzle
Inert gas	Argon
Sieve	63 µm

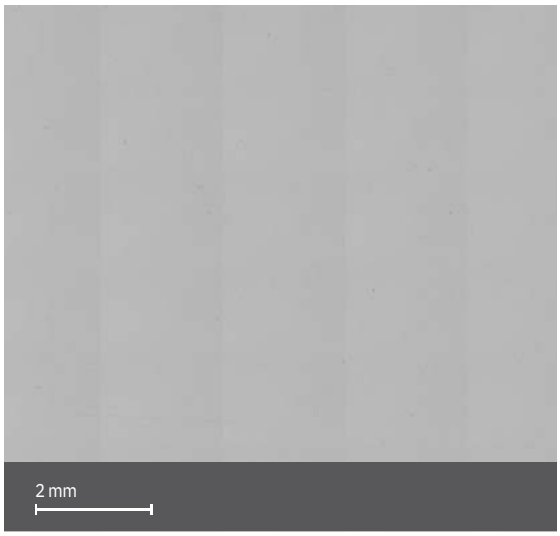
Additional information	
Layer thickness	20 µm
Min. wall thickness	0.3 - 0.4 mm
Typical dimensional change after HT	+0.02 %
Volume rate	2.0 mm3/s

Chemical and Physical Properties of Parts1



Chemical composition of built parts is compliant to EOS StainlessSteel 316L powder chemical composition.

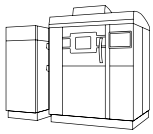
Micrograph of polished surface



Defects	Result	Number of samples
Average defect percentage	0.018 %	45

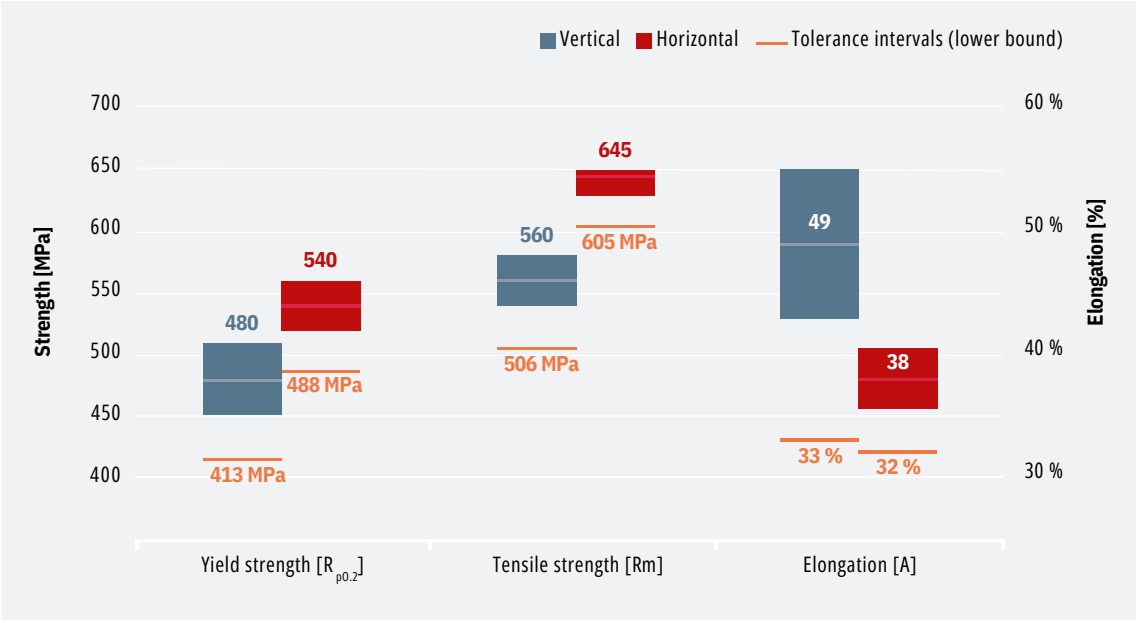
Density, ISO3369	Result	Number of samples
Average density	≥ 7.97 g/cm3	45

Mechanical Properties as Manufactured1



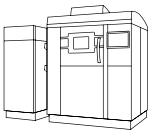
Mechanical properties ISO6892-1

	Yield strength Rp0.2 [MPa]	Tensile strength Rm [MPa]	Elongation at break A [%]	Number of samples
Ver tic al	480	560	49	363
Horizontal	540	645	38	246

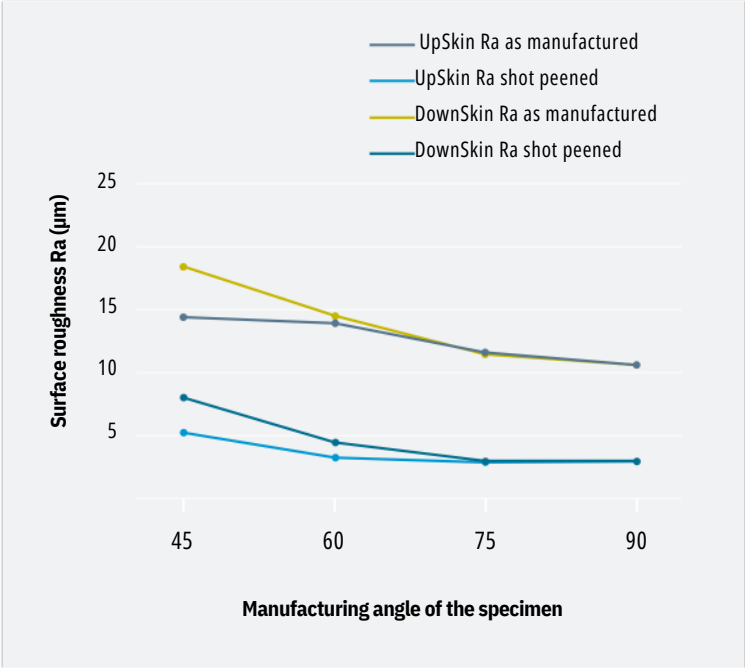


T99: Tolerance intervals provide lower bounds where 99 % of the population falls with 95 % confidence.
Tolerance intervals are based on validation data / QA statistics and are not directly transferable to other systems.

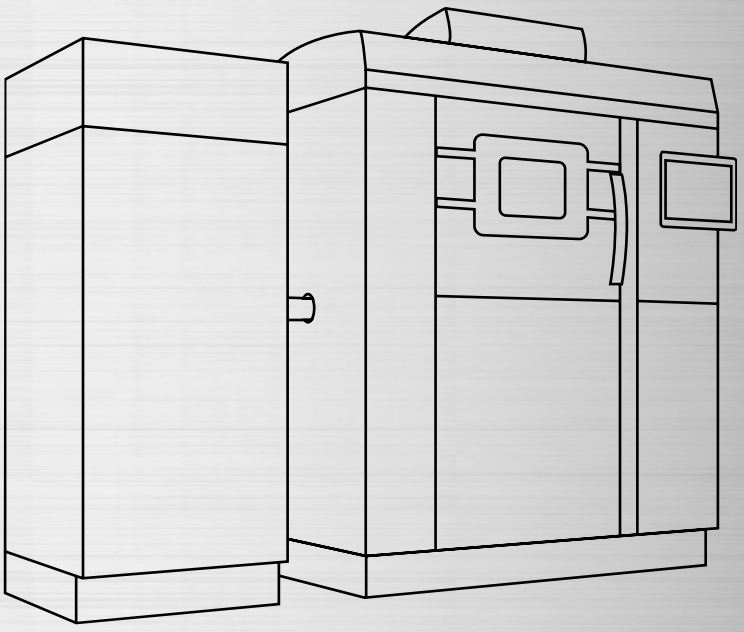
Additional Data1



Surface Roughness



TRL 7
Premium



EOS StainlessSteel 316L
for EOS M 290 | 40 µm

Process Information
Chemical and Physical Part Properties
Heat Treatment
Mechanical Properties
Additional Data

CR365 v03/12.2016

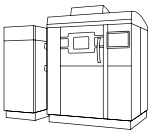
EOS StainlessSteel 316L for EOS M 290 | 40 µm
Process Information

This process product is optimized for building high quality parts with EOS M 290 system reliably using EOS StainlessSteel 316L. Mechanical properties have been validated to TRL7 level.

System set-up	EOS M 290
EOSPAR name	316L_040_FlexM291
Software requirements	EOSPRINT 2.7 or newer EOSYSTEM 2.11 or newer
Powder part no.	9 011- 0 0 32
Recoater blade	EOS HSS blade
Nozzle	EOS grid nozzle
Inert gas	Argon
Sieve	63 µm

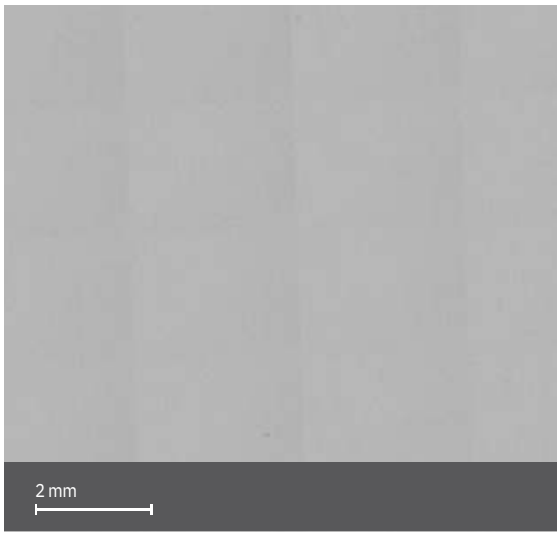
Additional information	
Layer thickness	40 µm
Min. wall thickness	0.1 mm
Typical dimensional change after HT	+0.2 %
Volume rate	3.7 mm3/s

Chemical and Physical Properties of Parts1



Chemical composition of built parts is compliant to EOS StainlessSteel 316L powder chemical composition.

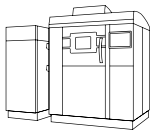
Micrograph of polished surface



Defects	Result	Number of samples
Average defect percentage	0.015 %	20

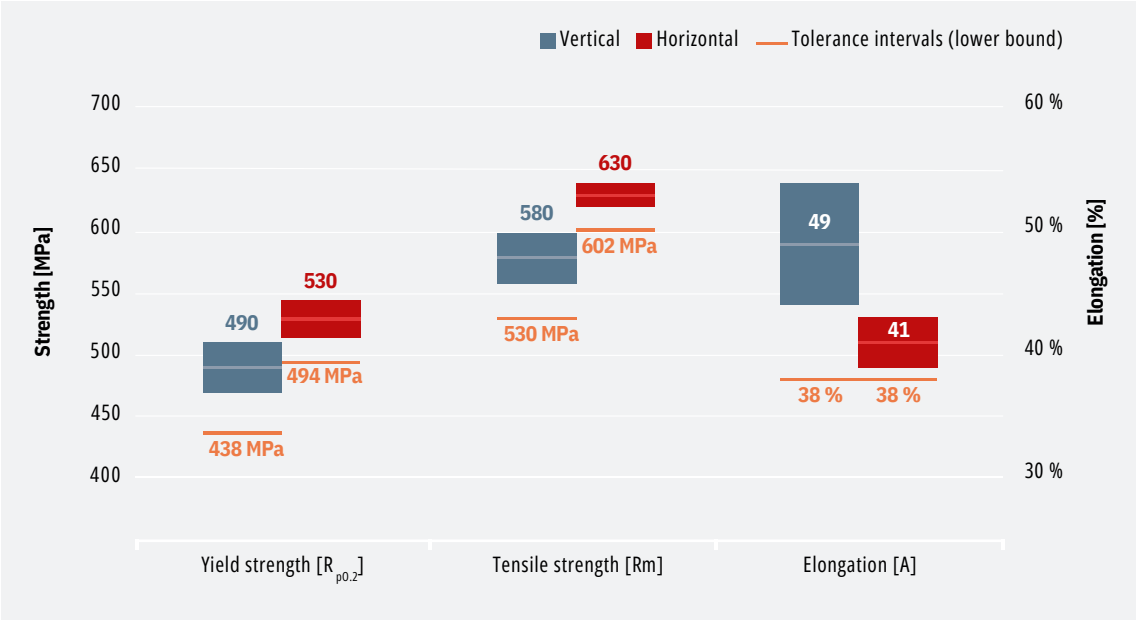
Density, ISO3369	Result	Number of samples
Average density	≥ 7.97 g/cm3	20

Mechanical Properties as Manufactured1



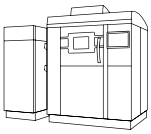
Mechanical properties ISO6892-1

	Yield strength Rp0.2 [MPa]	Tensile strength Rm [MPa]	Elongation at break A [%]	Number of samples
Ver tic al	490	580	49	162
Horizontal	530	630	41	72

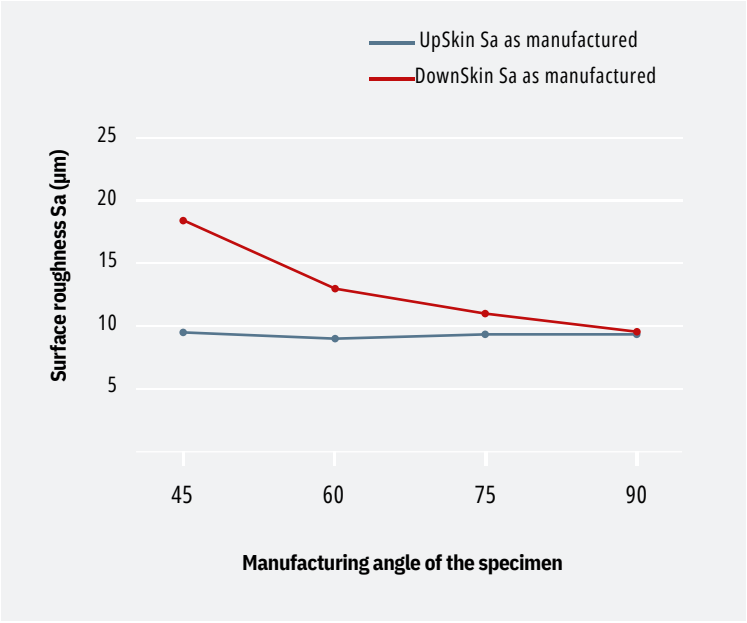


T95: Tolerance intervals provide lower bounds where 95 % of the population falls with 95 % confidence.
Tolerance intervals are based on validation data / QA statistics and are not directly transferable to other systems.

Additional Data1

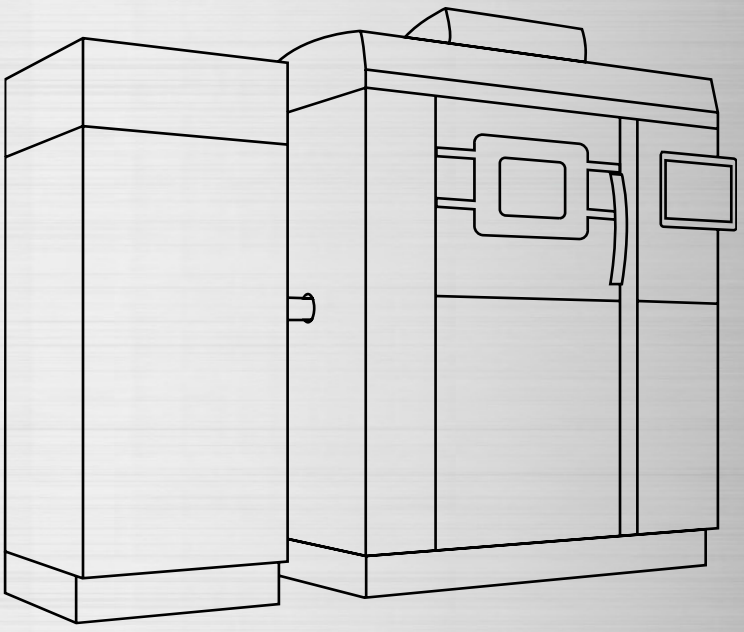


Surface Roughness



TRL 3

Core



EOS StainlessSteel 316L

for EOS M 290 | 40/80 µm

Process Information

Chemical and Physical Part Properties

Heat Treatment

Mechanical Properties

Additional Data

EOS StainlessSteel 316L for EOS M 290 | 40/80 µm
Process Information

This process product is optimized for flexible and fast production of EOS StainlessSteel 316L parts with the EOS M 290 system. The parameter set has three different layer thickness options that can all be utilized within the same build: 40 µm, 80 µm and 40/80 µm Skin.

The 40 µm parameter set is ideal for parts needing great detail resolution and more dense structure. The 80 µm parameter set offers a build rate that is more than double that of the long established 40 µm parameter set.
With the 40/80 µm Skin parameter set, the total build time can be reduced with the same surface quality. The parameter sets are assigned to different sections in the same build job depending on the requirements.

Main characteristics:

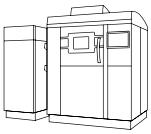
- → Parameter set for fast and cost efficient production of EOS StainlessSteel 316L parts in small series or serial production
- → With 80 µm parameter 100 % increase in productivity compared to the 40 µm FlexLine parameter set
- → Faster production without compromising the part quality

System set-up	EOS M 290
EOSPAR name	316L_040_080_Core M291
Software requirements	EOSPRINT 2.7 or newer EOSYSTEM 2.11 or newer
Powder part no.	9 011- 0 0 32
Recoater blade	EOS HSS blade
Nozzle	EOS grid nozzle
Inert gas	Argon
Sieve	63 µm

Additional information	
Layer thickness	40 µm, 80 µm & 40/80 µm Skin
Volume rate*	3.7 mm³/s (40 µm), 8.4 mm³/s (80 µm), 3.7 - 8.4 (40/80 µm Skin)

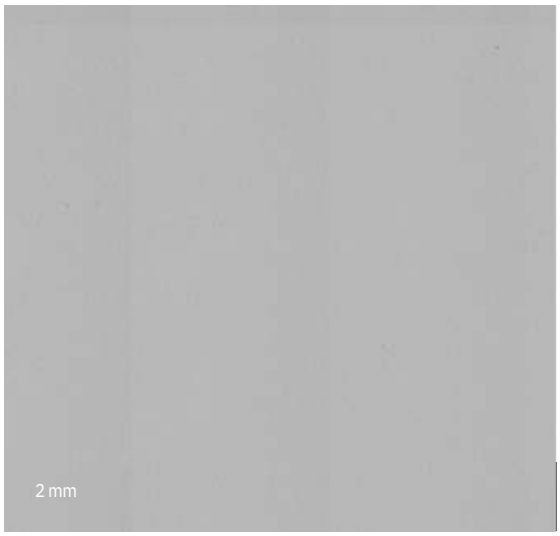
* Volume rate depends on the part dimensions and skin thickness.

Chemical and Physical Properties of Parts1

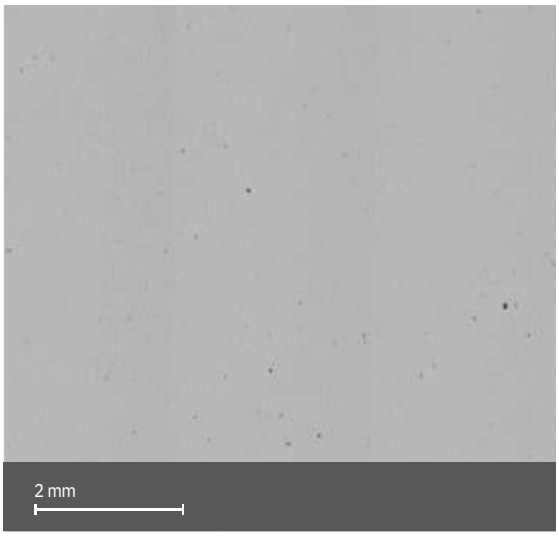


Chemical composition of built parts is compliant to EOS StainlessSteel 316L powder chemical composition.

Micrograph of polished surface (40 µm)



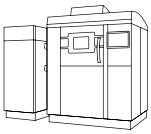
Micrograph of polished surface (80 µm)



Defects	Result
Average defect percentage	0.1 %* (40 µm), < 0.2 %* (80 µm)

* Defect % varies with platform position.

Mechanical Properties as Manufactured1

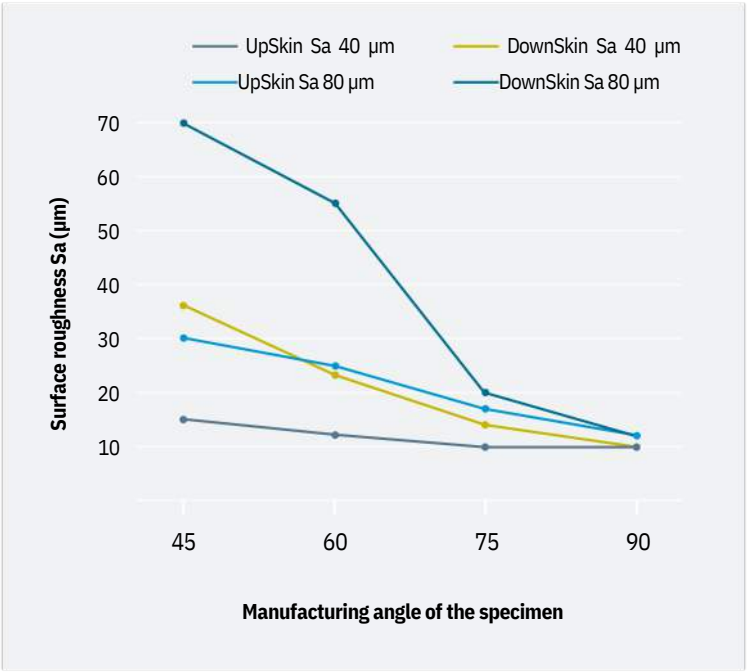


Typical properties as manufactured ISO 6892-1

	Yield strength Rp0.2 [MPa]	**Tensile strength** Rm [MPa]	**Elongation at break** A [%]
40 µm horizontal	500	600	35
40 µm vertical	450	550	50
80 µm horizontal	500	600	35
80 µm vertical	450	550	45

Additional Data1

Surface Roughness



IHR INDUSTRIEPARTNER FÜR ADDITIV GEFERTIGTE BAUTEILE

Wir «drucken» (3D Druck von Metall) Ihre Bauteile und liefern Ihnen diese inklusive der kompletten mechanischen Nacharbeit. Unser Fertigungsprozess garantiert eine hohe Qualität und Reproduzierbarkeit. Mit unserer Erfahrung unterstützen und beraten wir Sie gerne in der Konstruktion für den additiven Fertigungsprozess.

ECOPARTS

ADDITIVE METAL SOLUTIONS

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