Meltio Stainless Steel 316L

ER316LSI / G 19 12 3 L Si / 1.4430

SS316L is an austenitic steel with excellent durability, low reactivity and adequate elevated temperature properties. The alloy has a low carbon content which makes it particularly recommended when there is a risk of intergranular corrosion. Thus, parts manufactured with SS316L are an excellent choice in corrosion prone applications.

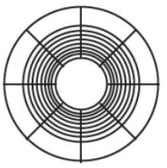
Properties	Corrosion Resistance, Machinable and Polishable
Applications	Machinery, Chemical and Food Industry and Naval

Wire Chemical Composition	Fe	C	Si	Mn	Cr	Ni	Mo
Weight Percent [%]	Bal.	0.02	0.9	1.7	18.5	12.0	2.7

Wire Density
8.0 g/cm³

Melting Point		
1671 K	1398 ºC	2548 °F

Spool Specs



Meltio Materials are tightly spooled and packaged to ensure the best compatibility with Meltio systems.

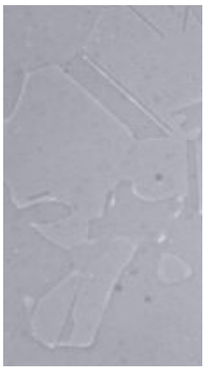
Wire Diameter	1.0 mm
Weight on Spool	15 kg
Volume on Spool	1875 cm³
Spool Type	BS300
Wire Coating	Uncoated

Relative density as 3D printed IR Laser	> 99.7%

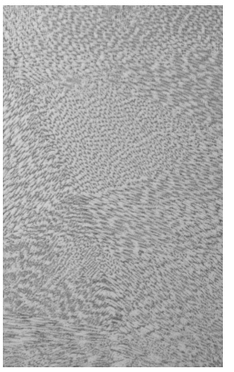
Micrography

The as-built SS316L samples show a microstructure with both cellular and columnar dendritic solidification mode. In as printed condition we find around 5.6% ferritic structures which are reduced to 0.2 % after heat-treatment of re-austenization.

As-printed XY
100x Magnification



HT XY
100x Magnification

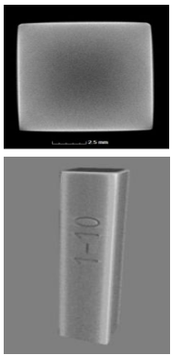


As-printed XY
100x Magnification

IR Laser	***Blue Laser***
Test Carried Out In IDONIAL *info@idonial.com*	

Tomography

CT Scan of 3D printed sample part in SS316L without detectable voids or defects. Resolution of 24 µm per pixel.



3D / Top View

Front View

IR Laser
Test Carried Out In CATEC *info@catec.aero*

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Deposition Parameters

The following printing parameters were obtained through rigorous testing. The **Infrared Profile** was derived from a 30 × 60 × 20 mm printed block, from which a 10 × 10 × 60 mm sample was extracted using EDM and analyzed via CT scan in an external laboratory. The **Blue Profile** was obtained from three scenarios (30 × 60 × 20 mm, 55 × 70 × 70 mm, and 250 × 250 × 30 mm) to ensure reliable unattended printing with maximum quality and energy density. Internally, samples were tested using Liquid Penetrant Testing (LPT) to evaluate surface-breaking defects on newly exposed internal surfaces after sectioning. Additional analyses, including Micrography, CT scan, and Structural testing, are conducted by an external lab.

These profiles are valid for 90% of solid parts, with a minimum part size of 30 × 30 mm. Their performance depends on geometry, overhangs, material, thickness, and base material. Profiles serve as a reference for specific applications, but operator expertise remains essential for achieving optimal print quality for the specific application. Adjustments may be necessary to overcome challenges or deviations from standard shapes.

The **Blue Profiles are under continuous development**, with updates released at least quarterly to enhance performance and reliability. The data presented reflects the current state, and improvements are ongoing. In case of doubts about performance or specific requirements, please contact the **Meltio Process Team** for guidance.

These printing parameters are available in **Meltio Horizon** and **Meltio Space** slicers latest release.

Technology	Revisión name	Laser Power [W]	Velocity [mm/s]	Argon Flow [l/min]	Layer Height [mm]	Layer Width [mm]	Wire Speed [mm/s]	Input Energy Density [J/mm3]	Deposition Rate [g/h]	Volume rate [cc/h
IR Laser 976 nm	**V.D.**	1100	7.5	10.0	1.0	1.0	9.6	146.6	196	24.81
Blue laser 450 nm	**Solid 1.0x1.2 Rev 9 2024-12-05**	1000	10	15.0	1.0	1.2	15.92	83.33	341	43.16

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Heat Treatment

With SS316L it is not mandatory to perform a heat-treatment after 3D printing for general use case applications. As-built Meltio SS316L parts show a mainly austenitic structure with some small ferrite content. This Ferrite content may be adjusted via re-austenization to fit the requirements of a specific application. Applying the heat-treatment a 99.8% austenitic structure structure can be achieved. SS316L may also be stress relieved between 450°C and 500°C without affecting its microstructure.

Re-austenization

Protective atmosphere	1050°C	Maintain for 2h	Cooling to RT

Typical Parameters for a cylinder sample of 4 mm diameter and 10 mm long extracted by EDM from a printed block of 160x30x70mm.

Mechanical Properties

Results show that specimens printed using Meltio's wire-laser metal 3D printed process perform at the same level as samples made with conventional manufacturing methods. Results show low deviations and near isotropic properties even in the as-printed state without the application of heat-treatments.

				UNE EN ISO 6892-1			
	Wire Properties	**Cast Properties *(ASTM A403)***	**Wrought Properties *(ASTM A351)***	**Meltio XY properties IR Laser *(R.A)***	**Meltio XZ properties IR Laser *(R.A)***	**Meltio XY properties IR Laser *(As printed)***	**Meltio XZ properties IR Laser *(As printed)***
Ultimate Tensile strength (UTS) [MPa]	620	515	550	556 ± 8	547 ± 8	643 ± 6	655 ± 11
Yield strength [MPa]	420	208	260	215 ± 3	253 ± 17	429 ± 16	347 ± 28
Elongation [%]	35	40	35	65 ± 1	62 ± 2	38 ± 2	41 ± 4
				Test Carried Out In IDONIAL *info@idonial.com*			

The following Mechanical Properties were obtained, based on a printed block of 160x30x70 mm using the Verified Density Parametrization, from it 16 ASTM E8M samples were extracted using EDM and were analyzed by an external laboratory.

			UNE EN ISO 6507-1		
	Cast Properties *(ASTM A403)*	**Wrought Properties *(ASTM A351)***	**Meltio Properties IR Laser *(R.A)***	**Meltio Properties IR Laser *(As printed)***	**Meltio Properties Blue Laser *(As printed)***
Hardness [HV-30]	215	225	192	198	173
			IR Laser Test Carried Out In IDONIAL *info@idonial.com* *Blue Laser Test Carried Out in CETEMET* *i+d+i@cetemet.es*		

Based on a printed block of 30x60x20 mm using Verified Density Parametrization. A sample from this block of 10x10x60 mm was extracted using EDM, and was analyzed by an external lab.

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Fatigue Life

The results demonstrate that specimens printed using Meltio's wire-laser metal 3D printing process can withstand high fatigue cycles, performing at the same level as samples produced using conventional manufacturing methods. The results also indicate that specimens exhibit good fatigue behaviour even in the as-printed state, without the application of heat treatments.

	ASTM E466	
	XZ properties IR Laser *(As printed)*	**XZ properties IR Laser *(R.A)***
Stress Range [Mpa]	220	190
Nº of Cycles (Nf)	5x10^6	
Stress Ratio (R)	-1	
	**Test Carried Out In IDONIAL* info@idonial.com	

The following Mechanical Properties were obtained, based on a printed block of 160x30x70 mm using the Verified Density Parametrization, from it 16 ASTM E466 samples were extracted using EDM and were analyzed by an external laboratory.

** Meltio's current work on material characterization is carried out using the Meltio M600 and it remains under constant development. Specifications provided herein may not reflect the latest state of our research. For further information and questions please contact us via info@meltio3d.com.*