

M300 Steel

Material & Process Capability

M300 Steel is an ultra-low carbon alloy with very high strength & hardness properties derived from intermetallic compounds rather than carbon content. The material is comprised mainly of nickel, with cobalt, molybdenum, & titanium as secondary intermetallic alloying metals.

It is ideal for tooling applications such as High Pressure Die Cast (HPDC) inserts, injection molding, and other types of tooling. The Velo3D fully integrated manufacturing solution uniquely enables companies to build the parts they need without compromising design or quality - resulting in complex parts higher in performance than traditional casting techniques or other additive methods.

General Process

This data sheet specifies the expected mechanical properties and characteristics of this alloy when manufactured on a Velo3D Sapphire System. All data is based on parts built using Velo3D standard 50 µm layer thickness parameters, using Praxair FE-339-3, a Velo3D-approved powder. Parts built from M300 on a Sapphire System can be heat treated like those manufactured by other methods.



Density, g/cc (lbs/cubic in)	8.0 (0.29)
Relative Density, percent	99.9+
Surface Finish ¹ , S _a , µm (µin)	<15 (590)

Mechanical Properties at Room Temperature

Process Recipe	Property ² TBR (cc/h) ³	Modulus of Elasticity, GPa (msi)		Ultimate Tensile Strength, MPa (ksi)		Yield (0.2% Offset), MPa (ksi)		Elongation At Break, percent		Charpy V-notch, J ⁶		Hardness, HRBW	
		Mean	Mean-3σ	Mean	Mean-3σ	Mean	Mean-3σ	Mean	Mean-3σ	Mean	Mean-3σ	Mean	Mean-3σ
1kW/50µm	As Printed ³	130 (19)	105 (15)	1015 (147)	995 (144)	800 (116)	780 (113)	18	14	44	31	29	25
	After Heat Treatment 1 ⁴	170 (25)	160 (23)	1490 (216)	1470 (213)	1280 (186)	1265 (184)	15	12	11	8	43	40
	After Heat Treatment 2 ⁵	168 (24)	157 (23)	1430 (207)	1380 (200)	1195 (173)	1115 (162)	18	11	24	20	46	45

1. Depends on orientation and process selected; for angles >25° from horizontal. **2.** All specimens were printed in argon atmosphere and tested using ASTM E8/E8M-22, ASTM E23-18, or ASTM E18-22. Mechanical & tensile samples printed in vertical orientation, machined to ASTM E8 (round specimen #3). **3.** TBR: Theoretical Build Rate (TBR) is a per-laser build rate calculated from the process conditions of bulk core as *scan speed x hatch spacing x layer thickness*. This value represents a single laser only and is reported for comparison purposes across different materials and recipes, but does not correspond to true build rate, which is dependent on geometry and system characteristics (i.e. number of lasers, recoat times, etc.). **4.** Solution at 850°C, 2 hours and age 600°C, 6 hours. **5.** Solution at 850°C, 2 hours and age 630°C, 1 hour. **6.** Charpy blocks were printed in the XY direction and machined.