

## Material Data Sheet

### M300 Tool Steel

#### Printer Process Specifications

Material	M300 tool steel (UNS K93120, 1.6354)
Layer Thickness (µm)	30
Laser Power (W)	100
Additive Manufacturing System	XM200C
Print Parameters	M300-C-30-210220

#### Material Description

M300 is an age hardenable martensitic tool steel with a high tensile strength and hardness. Its primary alloys are nickel (18 wt%), cobalt (9 wt%), and molybdenum (5 wt%), and less than 0.03% of carbon. These alloys aid in the excellent mechanical properties that arise with heat treatment, specifically age hardening. While high carbon tool steels are challenging to process using additive manufacturing, the specific alloying mixture allows for easier powder bed fusion.

#### Material Properties

- Very high hardness and strength
- Good corrosion resistance
- Age hardenable
- Good weldability

#### Applications

- Tool insets for injection moulding and die castings
- High-strength components
- Aircraft landing gear components

## General Wrought Material Data <sup>(1)</sup>

Density [g/cc]	8.00
Thermal Conductivity [W/m*K]	25.3
Melting Range [°C]	1412.8
Coefficient of Thermal Expansion (21 to 480 °C) [µm/(m*°C)]	10.1

<sup>(1)</sup> From AZO Materials

## Chemical Composition <sup>(2)</sup>

Element	Mass %
Fe	Balance
Co	7.0 - 9.0
Ni	17.0 - 19.0
Mo	4.5 - 5.2
Ti	0.3 - 1.2
Cr	0.50 Max
Al	0.15 Max
P	0.03 Max
C	0.03 Max
S	0.01 Max

<sup>(2)</sup> From Praxair Surface Technologies

## Heat Treatment

Testing samples were precipitation hardened at 940 °C for 2 hours and air cooled, then aged at 490 °C for 6 hours and air cooled.

## Mechanical Properties

	Mean Value	Standard Deviation
<b>Component Density [g/cc]</b>	7.97	--
<b>Percentage of Theoretical density</b>	99.6%	--
<b>Ultimate Tensile Strength (UTS) - ASTM E8</b>		
Horizontal (XY) [ksi (MPa)]	304 (2094)	9.42 (65)
Vertical (Z) [ksi (MPa)]	203 (1402)	13.6 (94)
<b>Yield Strength - ASTM E8</b>		
Horizontal (XY) [ksi (MPa)]	238 (1954)	24.2 (167)
Vertical (Z) [ksi (MPa)]	161 (1110)	4.21 (29)
<b>Elongation at Break - ASTM E8</b>		
Horizontal (XY)	3.49%	1.76%
Vertical (Z)	3.40%	1.50%
<b>Hardness (Rockwell) - ASTM E18</b>	54.8 HRC	0.7 HRC



### **Powder Particle Size Distribution** <sup>(3)</sup>

<b>Per ASTM B822 (Using Microtrac)</b>	<b>Min</b>	<b>Max</b>
-16	--	5
d10 (microns)	15	25
d50 (microns)	25	35
d90 (microns)	45	55

<sup>(3)</sup> From Praxair Surface Technologies

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