

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 ⁽¹⁾

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) [$\mu\text{m}/(\text{m}^{\circ}\text{C})$]	10.1

⁽¹⁾ From AZO Materials

Chemical Composition ⁽²⁾

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

⁽²⁾ 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

<u>XM200C</u>	Mean Value	Standard Deviation
Component Density [g/cc]	7.97	--
Percentage of Theoretical density	99.6%	--
Ultimate Tensile Strength (UTS) - ASTM E8		
Horizontal (XY) [ksi (MPa)]	304 (2094)	9.42 (65)
Vertical (Z) [ksi (MPa)]	203 (1402)	13.6 (94)
Yield Strength - ASTM E8		
Horizontal (XY) [ksi (MPa)]	238 (1954)	24.2 (167)
Vertical (Z) [ksi (MPa)]	161 (1110)	4.21 (29)
Elongation at Break - ASTM E8		
Horizontal (XY)	3.49%	1.76%
Vertical (Z)	3.40%	1.50%
Hardness (Rockwell) - ASTM E18	54.8 HRC	0.7 HRC

<u>XM200G</u>	Mean Value	Standard Deviation
Component Density [g/cc]	7.97	--
Percentage of Theoretical density	99.6%	--
Ultimate Tensile Strength (UTS) - ASTM E8		
Horizontal (XY) [ksi (MPa)]	312.6 (2155)	12.0 (82.8)
Vertical (Z) [ksi (MPa)]	313.7 (2163)	5.51 (38.3)
Yield Strength - ASTM E8		
Horizontal (XY) [ksi (MPa)]	285.7 (1970)	14.8 (102)
Vertical (Z) [ksi (MPa)]	267.4 (1844)	9.42 (65.0)
Elongation at Break - ASTM E8		
Horizontal (XY)	3.00%	1.37%
Vertical (Z)	4.00%	1.25%
Hardness (Rockwell) - ASTM E18	53.7 HRC	0.9 HRC

Powder Particle Size Distribution ⁽³⁾

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

⁽³⁾ From Praxair Surface Technologies



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