

# Maraging steel M300 powder for additive manufacturing

## Process specification

<b>Powder description</b>	Maraging steel
<b>Layer thickness</b>	40 µm
<b>Laser power</b>	400 W
<b>Additive manufacturing system</b>	AM 400

## Material description

Maraging steels form a class of iron alloys. This group of materials has a martensitic crystal structure and is strengthened via aging at approximately 500 °C (900 °F), hence the name 'maraging'. These ultra-low carbon alloys have very high strength and hardness properties derived from precipitation of intermetallic compounds rather than carbon content.

Nickel is the main alloying element, with cobalt, molybdenum, and titanium as secondary intermetallic alloying metals.

Maraging steel M300 is also commonly referred to as 1.2709.

## Material properties

- High strength
- High hardness
- High fatigue strength
- Good machinability

## Applications

- Tooling inserts
- Mould and die
- High strength components

## Generic data - wrought material

<b>Density</b>	8.1 g/cm <sup>3</sup>
<b>Thermal conductivity</b> (see note 1)	14.2 W/mK at 20 °C, 21.0 W/mK at 600 °C, 28.6 W/mK at 1300 °C
<b>Melting point</b>	1413 °C
<b>Coefficient of thermal expansion</b>	10.3 10 <sup>-6</sup> K <sup>-1</sup>

Note 1 Age hardened at 490 °C ±10 °C for 6 hrs.

Note 2 Tested at ambient temperature to ASTM E8. Machined prior to testing. Values based on a sample size of 6.

Note 3 Tested to ASTM E384-11, after polishing.

Note 4 Tested to JIS B 0601-2001 (ISO 97). As built after bead blasting.

## Composition of powder\*

Element	Mass / max. %
Iron	Balance
Nickel	17.00 to 19.00
Cobalt	7.00 to 10.00
Molybdenum	4.50 to 5.20
Titanium	0.30-1.20
Silicon	≤ 0.10
Manganese	≤ 0.15
Carbon	≤ 0.03
Phosphorous	≤ 0.01
Sulphur	≤ 0.01

\*ASTM standard composition powder. Renishaw powders are supplied to a tighter specification to minimise batch-to-batch variations. Results quoted in this data sheet are from samples produced using Renishaw's tighter specification powder. Please contact Renishaw for further information about specifications or if you require support in qualifying non-Renishaw powders.

## Mechanical properties of additively manufactured parts

	As built		Age hardened (See note 1)	
	Mean	Standard deviation ( $\pm 1\sigma$ )	Mean	Standard deviation ( $\pm 1\sigma$ )
<b>Tensile strength (UTS)</b> (See note 2)				
Horizontal direction (XY)	1147 MPa	3 MPa	1917 MPa	8 MPa
Vertical direction (Z)	1035 MPa	10 MPa	1952 MPa	23 MPa
<b>Yield strength</b> (see note 2)				
Horizontal direction (XY)	976 MPa	17 MPa	1873 MPa	26 MPa
Vertical direction (Z)	794 MPa	22 MPa	1898 MPa	29 MPa
<b>Elongation at break</b> (see note 2)				
Horizontal direction (XY)	15%	1%	6%	2%
Vertical direction (Z)	10%	2%	3%	1%
<b>Modulus of elasticity</b> (see note 2)				
Horizontal direction (XY)	185 GPa	9 GPa	218 GPa	22 GPa
Vertical direction (Z)	189 GPa	6 GPa	199 GPa	8 GPa
<b>Hardness (Vickers)</b> (see note 3)				
Horizontal direction (XY)	350 HV0.5	15 HV0.5	574 HV0.5	7 HV0.5
Vertical direction (Z)	357 HV0.5	12 HV0.5	561 HV0.5	13 HV0.5
<b>Surface roughness (<math>R_a</math>)</b> (See note 4)				
Horizontal direction (XY)	3.5 $\mu\text{m}$ to 4 $\mu\text{m}$			
Vertical direction (Z)	7.5 $\mu\text{m}$ to 10.5 $\mu\text{m}$			

Density of additively manufactured maraging steel M300 is typically 99.8%, measured optically on a 10 mm x 10 mm x 10 mm sample at 75x magnification.

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