

# MARAGING STEEL M300

## POWDER FOR ADDITIVE MANUFACTURING

### 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.

### PROCESS SPECIFICATION

POWDER DESCRIPTION	Maraging steel
LAYER THICKNESS	40 µm
LASER POWER	200 W
ADDITIVE MANUFACTURING SYSTEM	AM250 and AM 400

### MATERIAL PROPERTIES

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

### APPLICATIONS

- Tooling inserts
- Mould and die
- High strength components

### GENERIC DATA - WROUGHT MATERIAL

DENSITY	8.1 g/cm <sup>3</sup>
THERMAL CONDUCTIVITY	14.2 W/mK at 20 °C, 21.0 W/mK at 600 °C, 28.6 W/mK at 1300 °C
MELTING RANGE	413 °C
COEFFICIENT OF THERMA EXPANSION (SEE NOTE 1)	10.3 10 <sup>-6</sup> K <sup>-1</sup>

**Note 1** - Age hardening conditions: 1. Heat up to 500 °C ±10 °C over the course of 60 minutes to 90 minutes, hold temperature for 6 hours; 2. Furnace cool to 300 °C; 3. Air cool.

**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 (%)
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	STANDARD DEVIATION ( $\pm 1\sigma$ )	AGE HARDENED (SEE NOTE 1)	STANDARD DEVIATION ( $\pm 1\sigma$ )
<b>Tensile strength (UTS)</b> (See note 2)				
Horizontal direction (XY)	1141 MPa	7 MPa	1806 MPa	6 MPa
Vertical direction (Z)	1122 MPa	14 MPa	1794 MPa	9 MPa
<b>Yield strength</b> (see note 2)				
Horizontal direction (XY)	1016 MPa	8 MPa	1753 MPa	20 MPa
Vertical direction (Z)	999 MPa	20 MPa	1730 MPa	20 MPa
<b>Elongation at break</b> (See note 2)				
Horizontal direction (XY)	7.3%	1%	5.5%	1%
Vertical direction (Z)	7.5%	1%	7%	1%
<b>Modulus of elasticity</b> (see note 2)				
Horizontal direction (XY)	160 GPa	5 GPa	170 GPa	8 GPa
Vertical direction (Z)	162 GPa	10 GPa	175 GPa	11 GPa
<b>Hardness (Vickers)</b> (see note 3)				
Horizontal direction (XY)	363 HV0.5	5 HV0.5	542 HV0.5	7 HV0.5
Vertical direction (Z)	355 HV0.5	7 HV0.5	543 HV0.5	8 HV0.5
<b>Surface roughness (Ra)</b> (See note 4)				
Horizontal direction (XY)	3.5 $\mu\text{m}$ to 5 $\mu\text{m}$			
Vertical direction (Z)	4 $\mu\text{m}$ to 6 $\mu\text{m}$			

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.