DIRECT METAL LASER SINTERING

Maraging Steel MS1

Ultra-High Strength Steel for Precision Tooling

EOS Maraging Steel MS1 is a premium grade tool steel with 18% nickel content, designed for applications requiring exceptional strength, hardness, and dimensional stability. This material achieves superior mechanical properties through precipitation hardening, making it ideal for injection molding tools, mechanical engineering components, and precision manufacturing applications.



SURFACE FINISHES



Standard Finish Natural

Supports are carefully removed and parts are shot peened to a uniform matte surface, which also helps relieve residual stresses. Critical features may receive light machining for tighter tolerances.



Machining & Polishing Enhanced

Precision machining and polishing enhance surface quality for critical applications, achieving tighter tolerances and a smooth, high-gloss metallic finish.



Performance Paint Premium

An automotive-grade coating that enhances aesthetics and durability. Each part is hand-finished with professional-grade equipment for exceptional adhesion, in matte to semi-gloss with custom colour matching.

BUILD VOLUME	LEAD TIME	LAYER HEIGHT	TOLERANCE
250 × 250 × 325 mm	From 4 business days	0.02-0.05 mm	±0.3% (min ±0.3 mm)

MECHANICAL PROPERTIES

Maraging Steel MS1 has the strength and hardness that injection molding tools and inserts, precision cutting tools and dies, and aerospace manufacturing tooling demand. Heat-treated values come first, the condition most tools and load-bearing parts are used in, followed by as-built values for parts that are machined before aging.

As-built parts show some anisotropy, which heat treatment reduces, so aged parts reach almost the same strength in every build direction. Hardness, fatigue and impact values describe the peak-hardness aging cycle, which maximizes strength and hardness at the expense of impact toughness; allow for this in parts that see sudden shock loads.

PROPERTY	VALUE	TEST STANDARD
Tensile Strength, Heat Treated (Horizontal / Vertical)	**2085 / 2100 MPa**	ISO 6892-1
Yield Strength Rp0.2, Heat Treated (Horizontal / Vertical)	**2020 / 2010 MPa**	ISO 6892-1
Elongation at Break, Heat Treated (Horizontal / Vertical)	**4.5 / 4 %**	ISO 6892-1
Elastic Modulus (Heat Treated)	**190 GPa**	ASTM E132-04
Peak Hardness (aged 490 °C, 6 h)	**54 HRC**	ISO 6508
Hardness Range (Heat Treated)	**50–57 HRC**	EN ISO 6508-1 (EOS MDS 2017)
Fatigue Strength (Heat Treated)	**650 MPa**	ASTM E466 / ISO 12107
Charpy V-Notch Impact (aged 490 °C, peak hardness)	**≈ 10 J**	ISO 148
Tensile Strength, As Built (XY / Z)	**1200 / 1100 MPa**	ISO 6892-1
Yield Strength Rp0.2, As Built (XY / Z)	**1100 / 930 MPa**	ISO 6892-1
Elongation at Break, As Built (XY)	**12 %**	ISO 6892-1
Elastic Modulus, As Built (XY / Z)	**150 / 140 GPa**	ISO 6892-1
Hardness (As Built)	**33–37 HRC**	EN ISO 6508-1

THERMAL PROPERTIES

The maximum operating temperature is the service limit EOS gives for Maraging Steel MS1, high enough for mold inserts, hot pressing tools and industrial equipment near heat sources.

The solution anneal and aging values are the EOS heat treatment behind the heat-treated properties. Thermal conductivity rises after aging, which helps conformal-cooled inserts draw heat from the cavity, and the expansion coefficients for each temperature range let designers predict fits in hot tooling.

PROPERTY	VALUE	TEST STANDARD
Maximum Operating Temperature (approx.)	**400 °C**	EOS MDS 2014
Solution Annealing (2 h)	**940 °C**	EOS heat treatment
Aging Temperature (6 h, peak hardness)	**490 °C**	EOS heat treatment
Thermal Conductivity (Aged)	**20 W/m·K**	EOS MDS 2014
Thermal Conductivity (As Built)	**15 W/m·K**	EOS MDS 2014
Specific Heat Capacity	**450 J/kg·K**	EOS MDS 2014
Coefficient of Thermal Expansion (25–100 / 200 / 300 / 400 °C)	**10.6 / 10.9 / 11.2 / 11.5 ×10^{-6}/K**	ASTM E228

PHYSICAL PROPERTIES

Near-full density and a very low defect level keep critical features in tolerance and downstream finishing predictable. The dimensional change row is the allowance to make when features are machined to size before heat treatment.

As-built surfaces suit functional faces, and shot peening evens them out; mold cavities and sealing faces are machined or polished to a fine finish. The minimum wall thickness sets the thinnest rib or vane the process resolves. The composition rows give the EOS alloy limits; with chromium far below the level that defines a stainless steel, MS1 needs oil, coating or dry storage to protect it from corrosion.

PROPERTY	VALUE	TEST STANDARD
Part Density	**8.0–8.1 g/cm³**	ISO 3369
Average Defect Percentage (EOS M 290, 40 µm)	**0.04 %**	EOS method (polished cross-section)
Dimensional Change after Heat Treatment	**+0.1 %**	EOS MDS
Surface Roughness Ra (As Built, 40 µm)	**5 µm**	EOS MDS 2014
Surface Roughness Ra (Shot Peened)	**4–6.5 µm**	ISO 4287
Minimum Wall Thickness (approx.)	**0.3–0.4 mm**	EOS MDS 2014 / 2017
Chemical Composition	**18Ni300 (AMS 6514)**	EOS MDS
Nickel Content	**17–19 wt%**	EOS MDS
Cobalt Content	**8.5–9.5 wt%**	EOS MDS
Molybdenum Content	**4.5–5.2 wt%**	EOS MDS
Titanium Content	**0.6–0.8 wt%**	EOS MDS
Aluminum Content	**0.05–0.15 wt%**	EOS MDS
Carbon Content	**≤ 0.03 wt%**	EOS MDS 2017
Chromium Content	**≤ 0.5 wt%**	EOS MDS 2014 / 2017

COMPLIANCE

EOS states that the chemical composition of MS1 corresponds to AMS 6514 18Ni300 and European 1.2709 (X3NiCoMoTi 18-9-5), so drawings that call out these grades can be checked against supplier data.

These entries describe chemistry rather than product certification, since AMS 6514 covers wrought bars and forgings. EOS does not develop or certify MS1 powder for medical devices or food contact, so it is used for tooling rather than parts that touch patients or food.

STANDARD	STATUS
AMS 6514 (18Ni300) EOS states the chemical composition corresponds to AMS 6514 18Ni300 maraging steel (US 18% Ni Maraging 300)	Composition per EOS
1.2709 (X3NiCoMoTi 18-9-5) EOS states the chemical composition corresponds to European 1.2709 and German X3NiCoMoTi 18-9-5	Composition per EOS

MANUFACTURING

Heat treatment	**Aging at 490 °C for 6 hours**