Material data sheet

# EOS MaragingSteel MS1

EOS MaragingSteel MS1 is a tool steel powder intended for processing on EOS DMLS™ systems.

This document provides information and data for parts built using

- EOS Powder: EOS MaragingSteel MS1 (EOS art.-no. 9011-0016)
- EOS Laser Sintering Machine: EOS M400-4
  - Ceramic Blade (EOS art.-no. 300007622)
  - DirectBase S40 Building Platform (EOS art.-no. 300000729)
  - Nitrogen atmosphere
  - 63 µm mesh for powder sieving recommended (EOS art.-no. 9044-0032 for IPCM M Extra Sieving Module or EOS art.-no. 200001059 for IPM M Powder Station L)
  - EOSYSTEM v. 2.5* or higher
- EOS Software:
  - EOSPRINT v. 1.6 (EOS art.-no. 7501-4031) or higher
- EOS Process:
  - MS1 ParameterEditor (EOS art.-no. 7500-3068)
  - Name of the Default Job: MS1_040_FlexM404_100.eosjob

* EOSYSTEM v. 2.6 or higher enables EOSPRINT v. 2.0 (EOS art.-no. 7012-0119) or higher usage

## Description

EOS MaragingSteel MS1 has a chemical composition following US classification 18% Ni Maraging 300, European 1.2709 and German X3NiCoMoTi 18-9-5. This kind of steel is characterized by having very good mechanical properties, and being easily heat-treatable using a simple thermal age-hardening process to obtain excellent hardness and strength.

Parts built from EOS MaragingSteel MS1 are easily machinable after the building process and can be easily post-hardened to more than 50 HRC by age-hardening at 490 °C (914 °F) for 6 hours. In both as-built and age-hardened states the parts can be machined, spark-eroded, welded, micro shot-peened, polished and coated if required.

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Due to the layerwise building method, the parts have a certain anisotropy, which can be reduced or removed by appropriate heat treatment - see Technical Data for examples.

## Technical Data

### Powder properties

The chemical composition of the powder (wt-%):

**Material composition**

| Element | Min | Max |
|---|---|---|
| Fe | Balance | |
| Ni | 17.00 | 19.00 |
| Co | 8.50 | 9.50 |
| Mo | 4.50 | 5.20 |
| Ti | 0.60 | 0.80 |
| Al | 0.05 | 0.15 |
| Cr | - | 0.50 |
| Cu | - | 0.50 |
| C | | 0.03 |
| Mn | | 0.10 |
| Si | | 0.10 |
| P | | 0.01 |
| S | | 0.01 |

**Max. particle size**

| | |
|---|---|
| > 63µm [1] | max 0.5 wt.-% |

[1] Sieve analysis according to ASTM B214.

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## General process data

| | |
|---|---|
| Layer thickness | 40 µm |
| Volume rate [2] | Up to 4 x 4.2 mm³/s (4 x 15.1 cm³/h) |

[2] The volume rate is a measure of build speed during laser exposure of the skin area. The total build speed depends on this volume rate and other factors such as exposure parameters of contours, supports, up- and downskin, recoating time, Home-In or LPM settings, job design (load, part geometry or overlap settings).

## Physical and chemical properties of parts*

| | |
|---|---|
| Part density [3] | 8.0-8.1 g/cm3 |
| Part accuracy [4] | |
| Small parts | Approx. ± 50 µm |
| Large parts | Approx ± 0.1 % |
| Min. wall thickness [5] | Approx. 0.3 - 0.4 mm |
| Surface roughness after shot peening [6] | |
| | Ra 4-6.5 µm; Rz 20-50 µm |

[3] Weighing in air and water according to ISO 3369.

[4] Based on users' experience of dimensional accuracy for typical geometries, e.g. ± 50 µm when parameters can be optimized for a certain class of parts or ± 0.1% when building a new kind of geometry for the first time or building larger parts. Part accuracy is subject to appropriate data preparation and postprocessing.

[5] Mechanical stability is dependent on geometry (wall height etc.) and application.

[6] Measurement according to ISO 4287. Due to the layerwise building the roughness strongly depends on the orientation of the surface, for example sloping and curved surfaces exhibit a stair-step effect.

## Hardness in heat treated status* [7]

| | |
|---|---|
| Hardness Rockwell C [8] | 50-57 HRC |

[7] Heat treatment procedure: Ageing temperature 490 °C 6 hours, air cooling

[8] Rockwell C (HRC) hardness measurement according to EN ISO 6508-1 on polished surface

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## Tensile data at room temperature* [9,10]

| | As built | |
|---|---|---|
| | **Horizontal** | **Vertical** |
| Ultimate tensile strength, Rm | 1200 MPa | 1200 MPa |
| Yield strength, Rp0.2 | 1020 MPa | 1050 MPa |
| Elongation at break, A [11] | 13 % | 11 % |
| | **Heat treated [7]** | |
| | **Horizontal** | **Vertical** |
| Ultimate tensile strength, Rm | 2060 MPa | 2080 MPa |
| Yield strength, Rp0.2 | 1990 MPa | 2010 MPa |
| Elongation at break, A [11] | 4 % | 3 % |

[9] Tensile testing according to. ISO 6892-1 B10, proportional test pieces, diameter of the neck area 5 mm, original gauge length 25 mm.

[10] The numbers are average values determined from samples with horizontal and vertical orientation respectively

[11] Elongation values depend on the thermal load of particular job layout as well as the positioning on the platform.

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## Abbreviations

| | |
|---|---|
| Min. | Minimum |
| Max. | Maximum |
| Approx. | Approximately |
| Wt. | Weight |

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This powder has not been developed, tested or certified as a medical device according to Directive 93/42/EEC (MDD) or Regulation (EU) 2017/745 (MDR) and is not intended to be used as a medical device, in particular for the purposes specified in Art. 2 No. 1 MDR. Insofar as you intend to use the powder as raw material for the manufacture of pharmaceutical products or medical devices (e.g. as raw material which as a material must meet the requirements of Annex 1, Chapter II MDR), the responsibility and liability for all analyses, tests, evaluations, procedures, risk assessments, conformity assessments, approval and certification procedures as well as for all other official and regulatory measures required for this purpose shall lie solely with you both with regard to the pharmaceutical product and/or medical device manufactured by you and with regard to the properties, suitability, testing, evaluation, risk assessment, other requirements for use of the powder as raw material.
This also applies to applications with food contact. In this respect, the limitations of liability pursuant to our General Terms and Conditions and the system sales or material contracts shall apply.



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