

EOS Maraging- Steel MS1

Ultra High Strength Tooling Grade Maraging Steel

EOS MaragingSteel MS1

EOS MaragingSteel MS1 is an ultra high strength tooling grade maraging steel. Its excellent properties are enabled by forming intermetallic phases and precipitates in heat treatment. Its nickel, cobalt, molybdenum and titanium alloying results in an excellent material for additive manufacturing, providing low distortion and balanced properties. The properties enable successful use in diverse applications including injection molding and cold and hot working.

Main Characteristics:

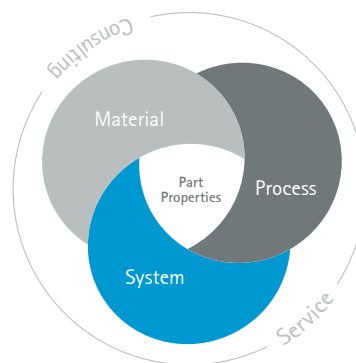
- Ultra high strength and hardness
- Properties adjustable with different heat treatment
- Low distortions
- Good machinability

Typical Applications:

- Plastic injection molding
- Extrusion tools
- Hot pressing tools

The EOS Quality Triangle

EOS uses an approach that is unique in the AM industry, taking each of the three central technical elements of the production process into account: the system, the material and the process – together simply described as the Quality Triangle. EOS focuses on delivering reproducible part properties for the customer.



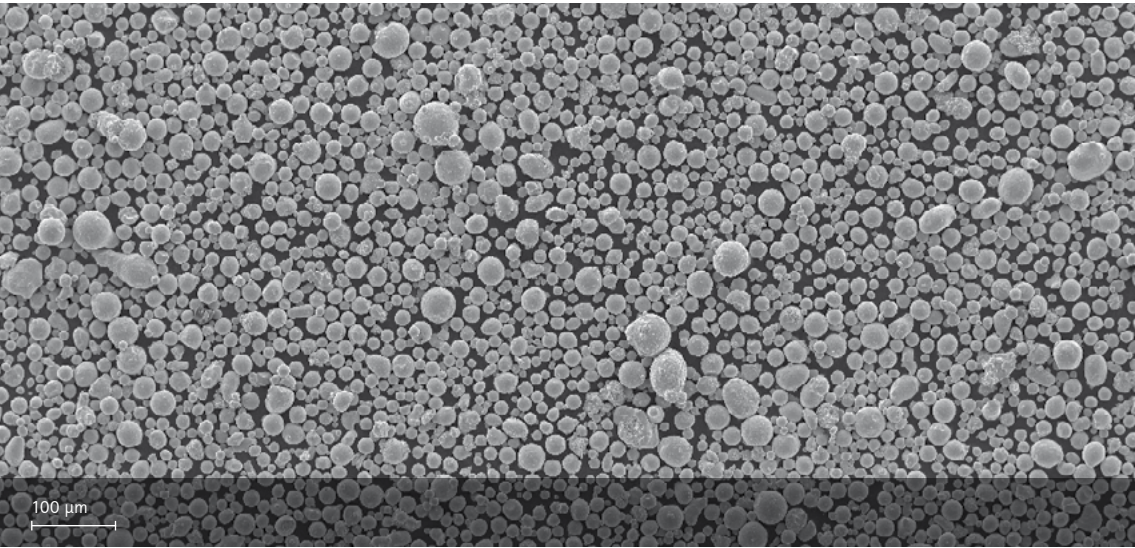
All of the data stated in this material data sheet is produced according to EOS Quality Management System and international standards.

Powder Properties

The chemical composition of EOS MaragingSteel MS1 corresponds to AMS6514 18Ni300 maraging steel standard.

Powder chemical composition (wt.-%)			Powder particle size	
Element	Min.	Max.	Generic particle size distribution	15 – 65 µm
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		

SEM picture of
EOS MaragingSteel MS1 powder.

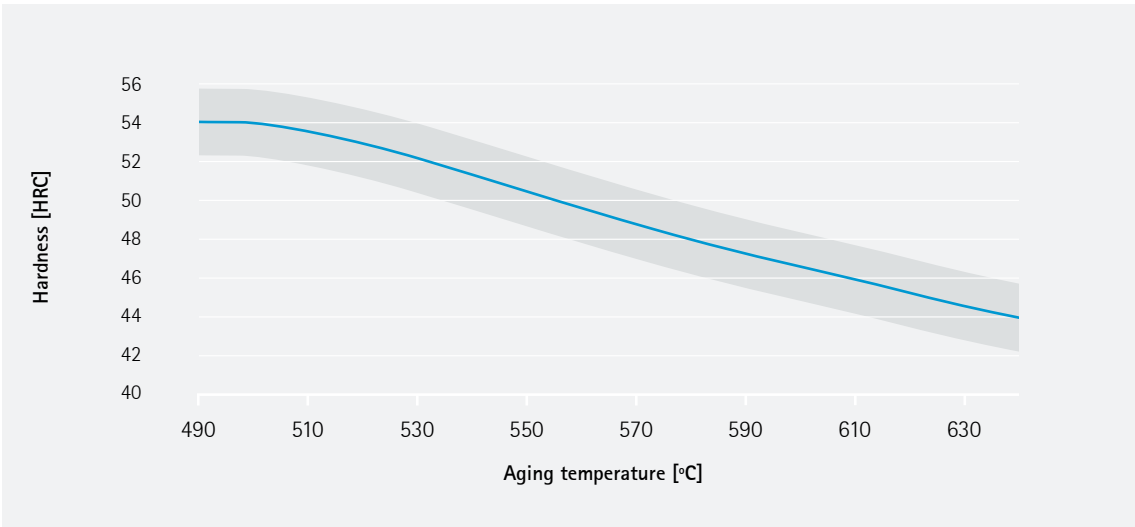


Heat Treatment

EOS MaragingSteel can be heat treated to match various needs of different applications. The two step heat treatment can be performed under vacuum or inert gas atmosphere. First step is solution annealing to minimize amount of austenite in the martensitic matrix. The needed hardness and strength is achieved through aging treatment where hardening takes place through forming of intermetallic phases and precipitates.

Solution annealing: 2 h at 940 °C (± 10 °C) measured from the part followed by rapid air cooling to room temperature (below 32 °C). Cooling rate 5-60 °C/min. Reaching room temperature before starting aging treatment is required to achieve desired microstructure.

Aging: For peak hardness of 54 HRC age 6 h at 490 °C (± 10 °C) measured from the part followed by air cooling. Mechanical properties presented in this document achieved through this aging procedure. For lower hardness and strength choose aging temperature according to the graph below



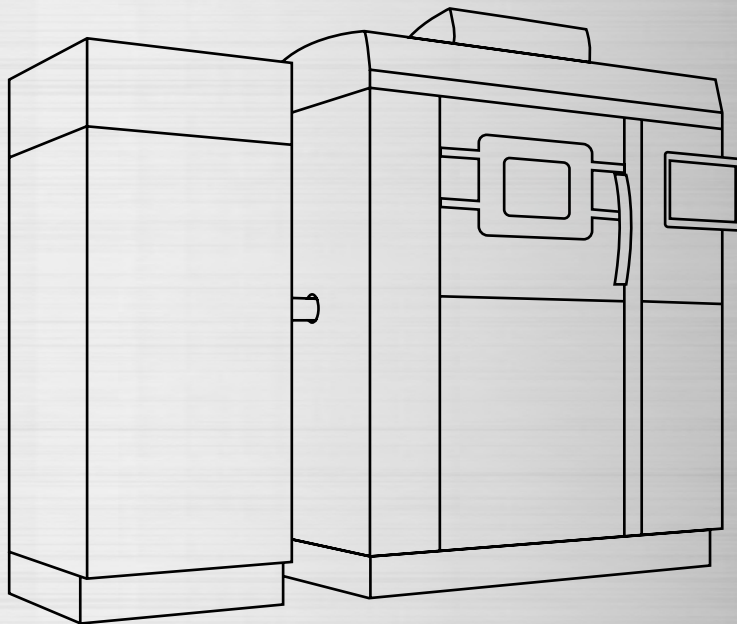
Rockwell C hardness according to ISO 6508

Coefficient of Thermal Expansion ASTM E228

Temperature	25-100 °C	25-200 °C	25-300 °C	25-400 °C
CTE	10.6 *10 ⁻⁶ /K	10.9*10 ⁻⁶ /K	11.2*10 ⁻⁶ /K	11.5*10 ⁻⁶ /K

Modulus of Elasticity ASTM E 132-04

State	Heat treated
Modulus of elasticity [GPa]	190



EOS MaragingSteel MS1 for EOS M 290 | 40 μm

Process Information
Chemical and Physical Part Properties
Mechanical Properties
Additional Data

EOS MaragingSteel MS1 for EOS M 290 | 40 µm

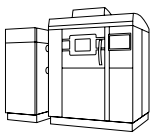
Process Information

This process product is optimized for building high quality parts with EOS M 290 system using EOS MaragingSteel MS1.

System set-up	EOS M 290
EOSPAR name	MS1_040_PerformanceM291
Also compatible with	EOS M290-2 400W
Powder part no.	9011-0016 9030-0024
Recoater blade	Ceramic blade
Nozzle	Grid nozzle
Inert gas	Nitrogen
Sieve	63 µm

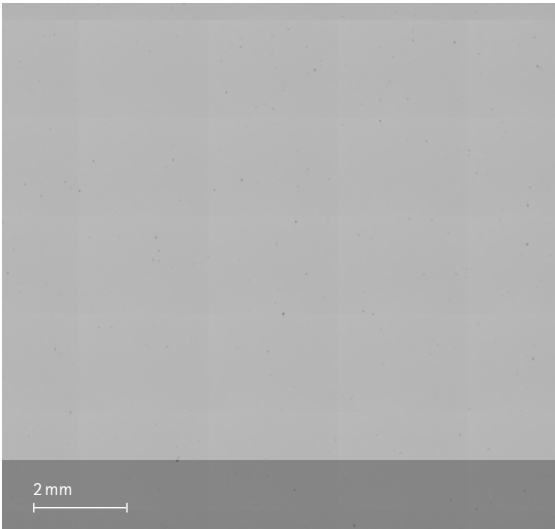
Additional information	
Layer thickness	40 µm
Typical dimensional change after HT	+0.1 %
Volume rate	4.2 mm³/s

Chemical and Physical Properties of Parts¹



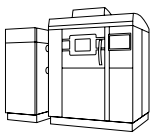
Chemical composition of printed parts matches the chemistry of EOS MaragingSteel MS1 powder.

Micrograph of polished surface



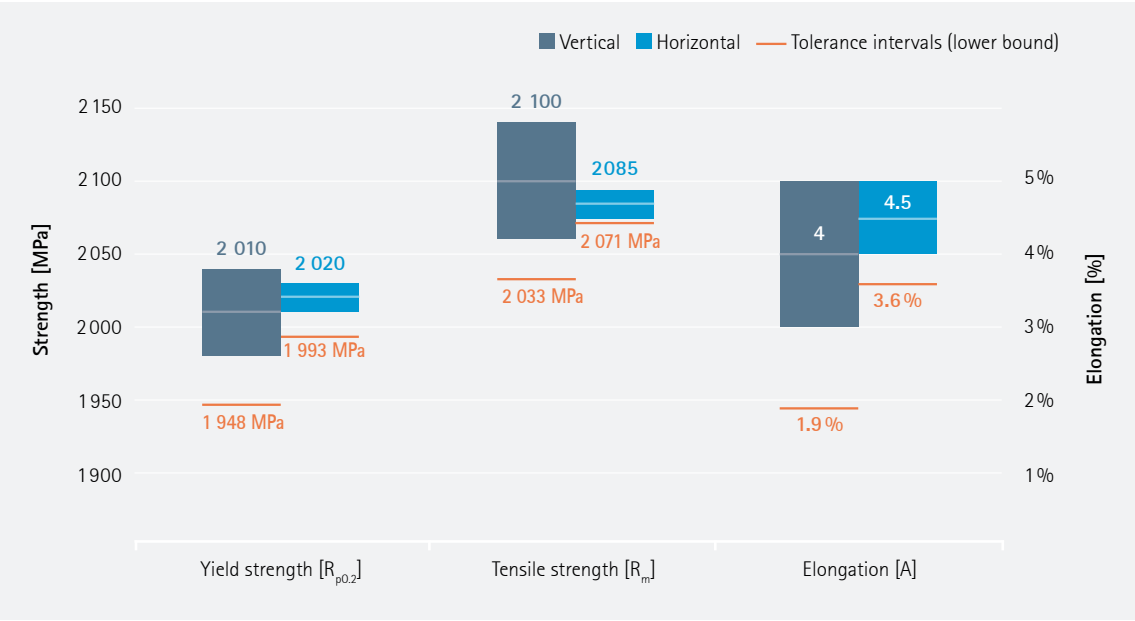
Defects	Result	Number of samples
Average defect percentage	0.04 %	10

Mechanical Properties¹

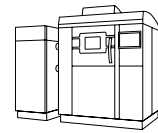


Mechanical properties ISO6892-1

Heat treated	Yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation at break A [%]
Vertical	2 010	2 100	4
Horizontal	2 020	2 085	4.5

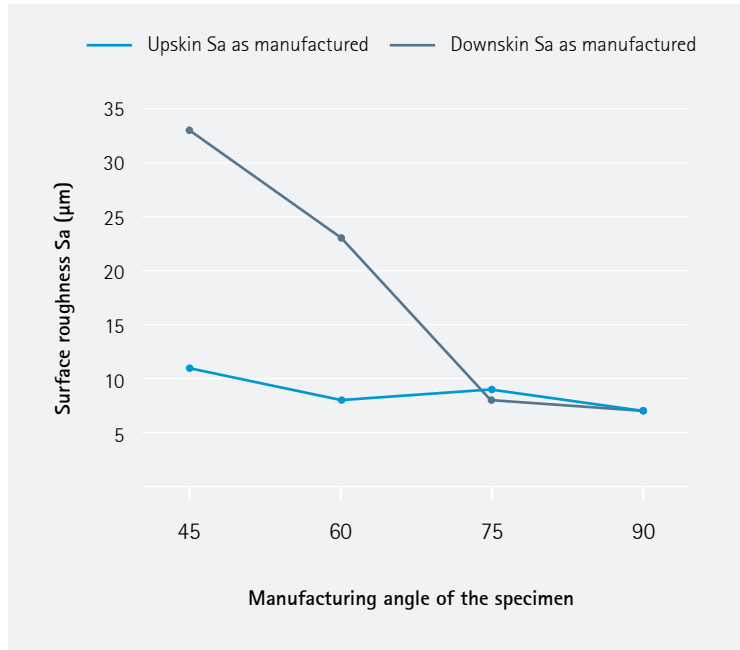


T95: Tolerance intervals provide lower bounds where 95 % of the population falls with 95 % confidence. Tolerance intervals are based on validation data / QA statistics and are not directly transferable to other systems.



Additional Data¹

Surface Roughness

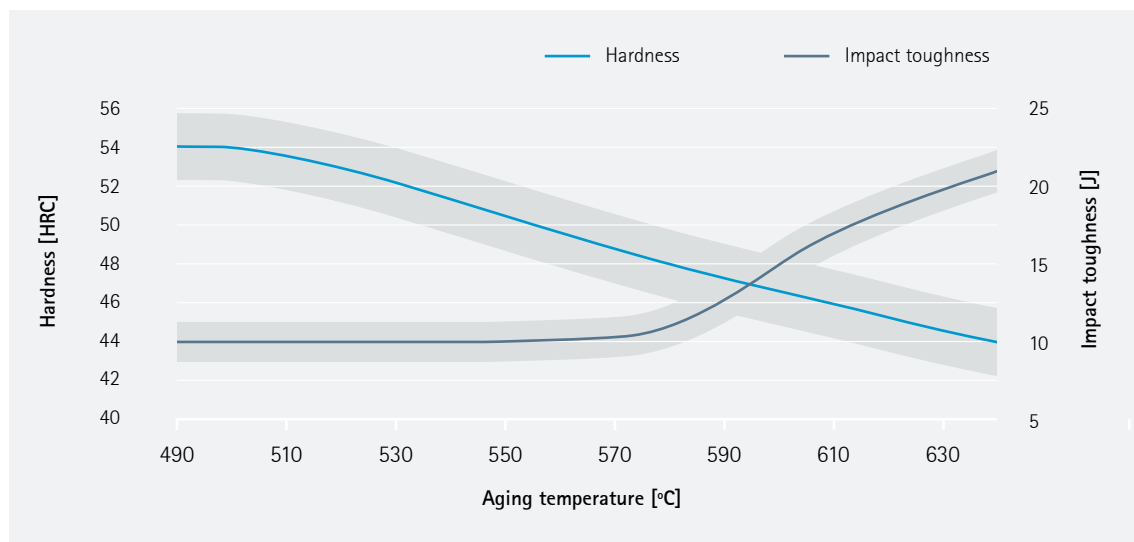


Fatigue Strength

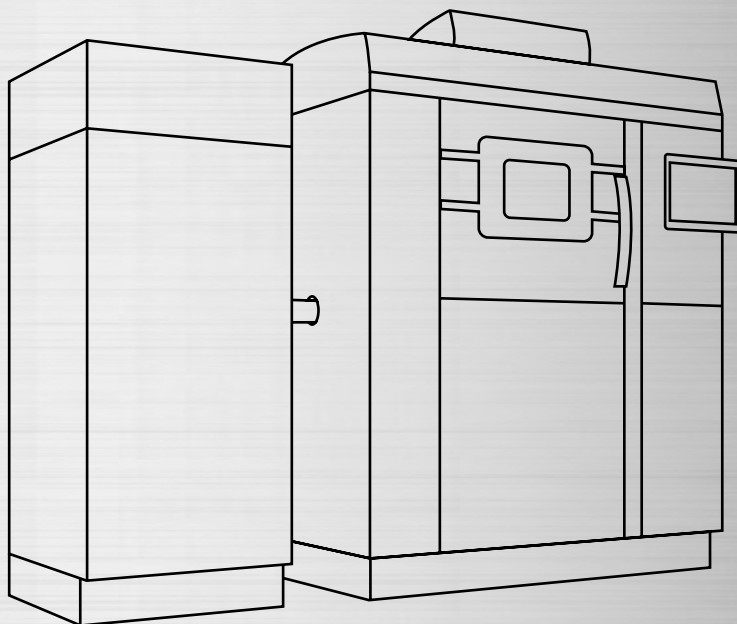
State	Heat treated
Fatigue strength [MPa]	650

Fatigue strength determines a stress level where specimen fails at a defined number of stress cycles. Fatigue strength was estimated statistically according to ISO 12107. Testing was performed according to ASTM E466. Fatigue results typically show large deviations due to the nature of the fatigue process.

Impact Toughness



Charpy-V impact toughness in relation to hardness and aging temperature according to ISO 148.



EOS MaragingSteel MS1 for EOS M 290 | 50 μm

Process Information

Chemical and Physical Part Properties

Mechanical Properties

Additional Data

EOS MaragingSteel MS1 for EOS M 290 | 50 µm

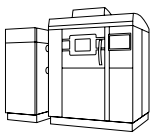
Process Information

This process product is optimized for fast production of MS1 parts with EOS M 290.

System set-up		EOS M 290
EOSPAR name		MS1_050_SpeedM291
Also compatible with		EOS M290-2 400W
Powder part no.		9011-0016 9030-0024
Recoater blade		Ceramic blade
Nozzle		Grid nozzle
Inert gas		Nitrogen
Sieve		63 µm

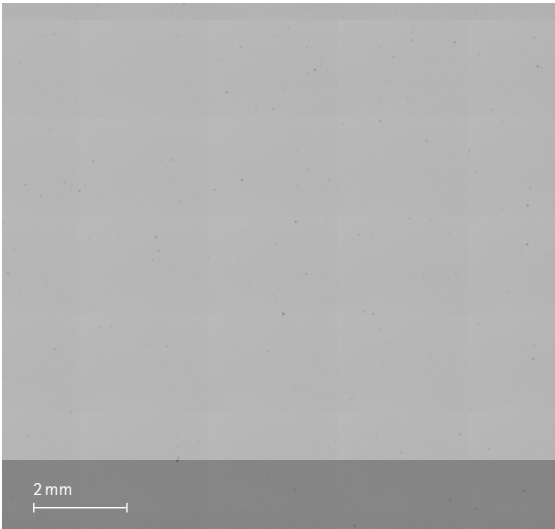
Additional information	
Layer thickness	50 µm
Typical dimensional change after HT	+0.1 %
Volume rate	5.5 mm³/s

Chemical and Physical Properties of Parts¹



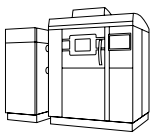
Chemical composition of printed parts matches the chemistry of EOS MaragingSteel MS1 powder.

Micrograph of polished surface



Defects	Result
Average defect percentage	< 0.1 %

Mechanical Properties¹

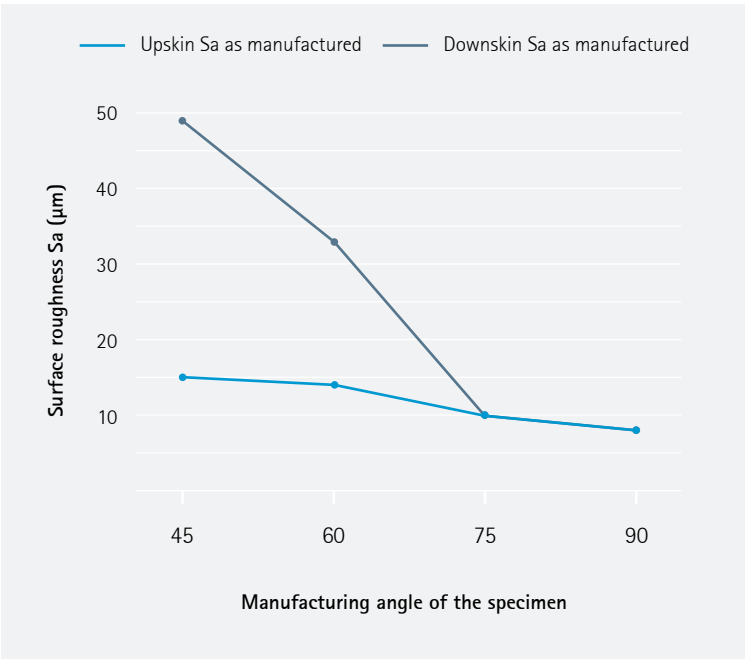


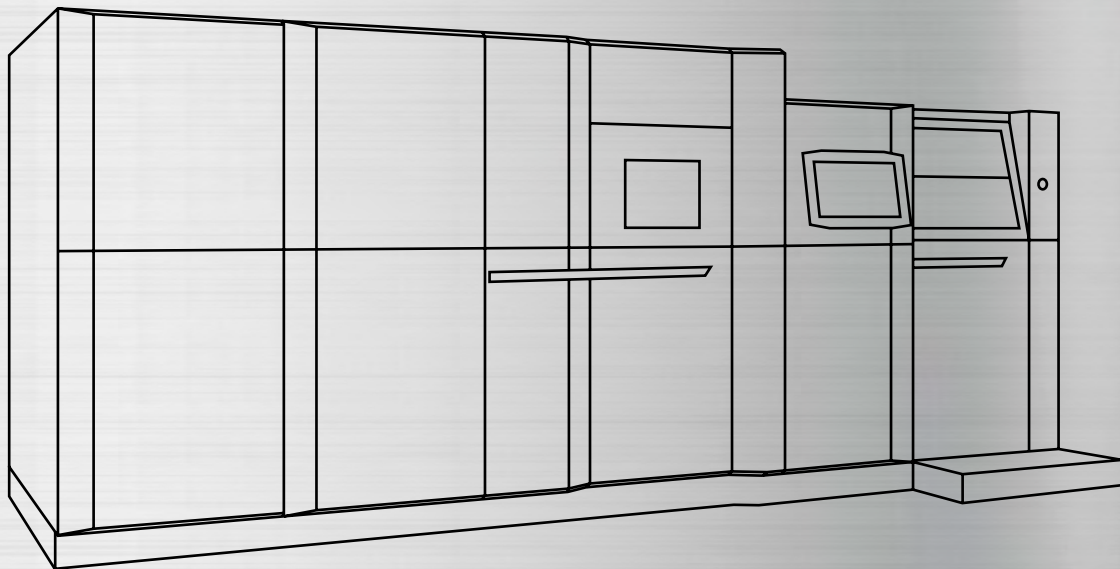
Mechanical properties ISO6892-1

Heat treated	Yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation at break A [%]
Vertical	2 000	2 100	2
Horizontal	2 030	2 100	3

Additional Data¹

Surface Roughness





EOS MaragingSteel MS1 for EOS M 300-4 | 50 μm

Process Information

Chemical and Physical Part Properties

Mechanical Properties

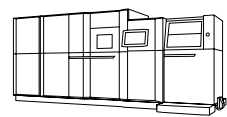
EOS MaragingSteel MS1 for EOS 300-4 | 50 µm
Process Information

This process product is optimized for fast production of MS1 parts with EOS M 300-4.

System set-up		EOS M 300-4
EOSPAR name		MS1_050_CoreM304
Software requirements		EOSPRINT 2.8 or newer EOSYSTEM 2.11 or newer
Powder part no.		9011-0016 9030-0024
Recoater blade		Ceramic blade
Inert gas		Nitrogen
Sieve		63 µm

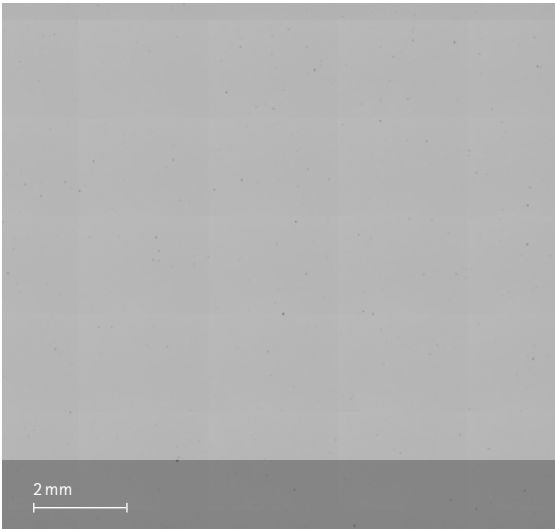
Additional information	
Layer thickness	50 µm
Typical dimensional change after HT	+0.1 %
Volume rate	up to 4 x 5.5 mm³/s

Chemical and Physical Properties of Parts¹



Chemical composition of printed parts matches the chemistry of EOS MaragingSteel MS1 powder.

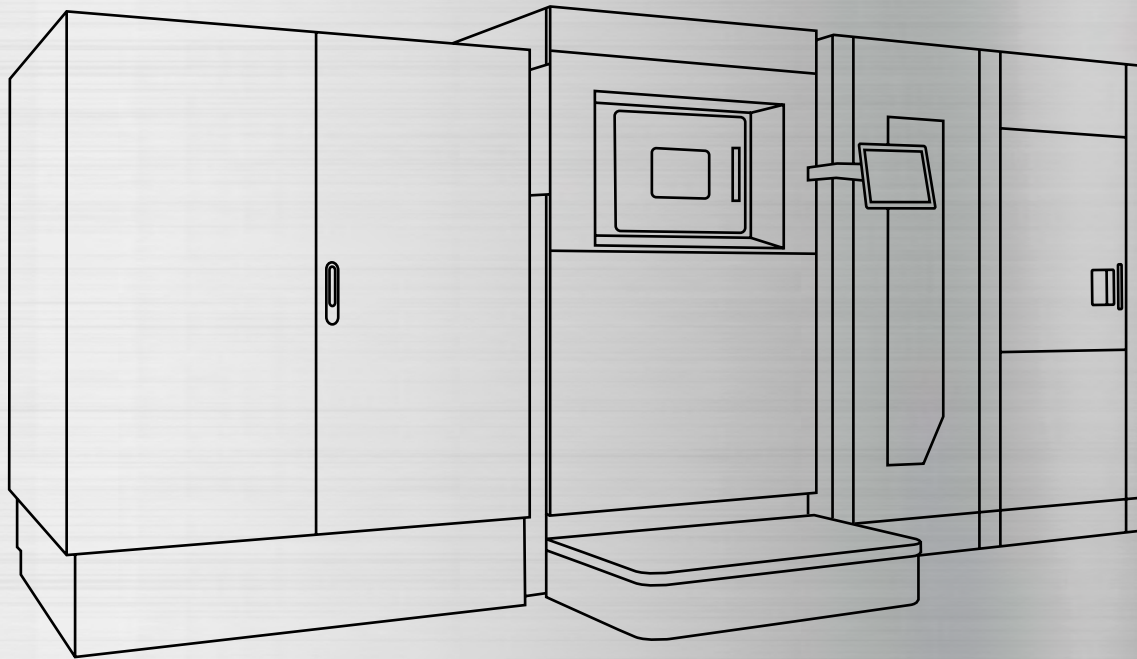
Micrograph of polished surface



Defects	Result
Average defect percentage	< 0.1 %

Mechanical Properties¹

Mechanical properties ISO6892-1			
Heat treated	Yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation at break A [%]
Vertical	1990	2 110	3
Horizontal	2040	2 120	4



EOS MaragingSteel MS1 for EOS M 400-4 | 40 μm

Process Information

Chemical and Physical Part Properties

Mechanical Properties

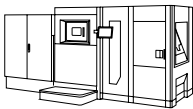
EOS MaragingSteel MS1 for EOS M 400-4 | 40 µm
Process Information

This process product is optimized for building high quality parts with EOS M 400-4 system using EOS MaragingSteel MS1.

System set-up		EOS M 400-4
EOSPAR name		MS1_040_FlexM404
Powder part no.		9011-0016 9030-0024
Recoater blade		Ceramic blade
Nozzle		Standard
Inert gas		Nitrogen
Sieve		63 µm

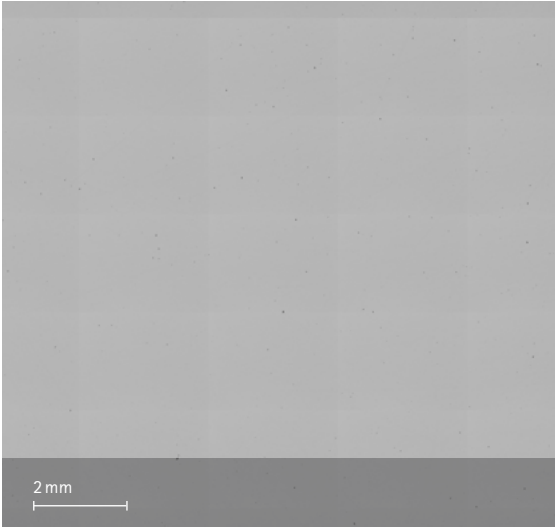
Additional information	
Layer thickness	40 µm
Typical dimensional change after HT	+0.1 %
Volume rate	up to 4 x 4.2 mm³/s

Chemical and Physical Properties of Parts¹



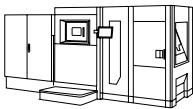
Chemical composition of built parts is compliant to EOS MaragingSteel MS1 powder chemical composition.

Micrograph of polished surface



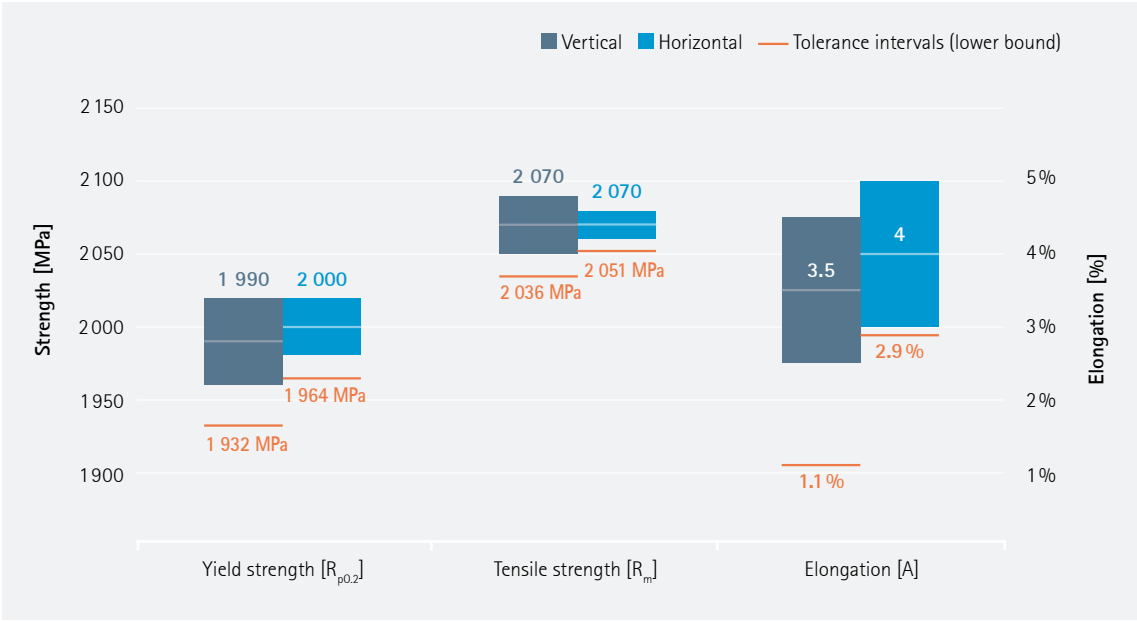
Defects	Result
Average defect percentage	< 0.1 %

Mechanical Properties¹

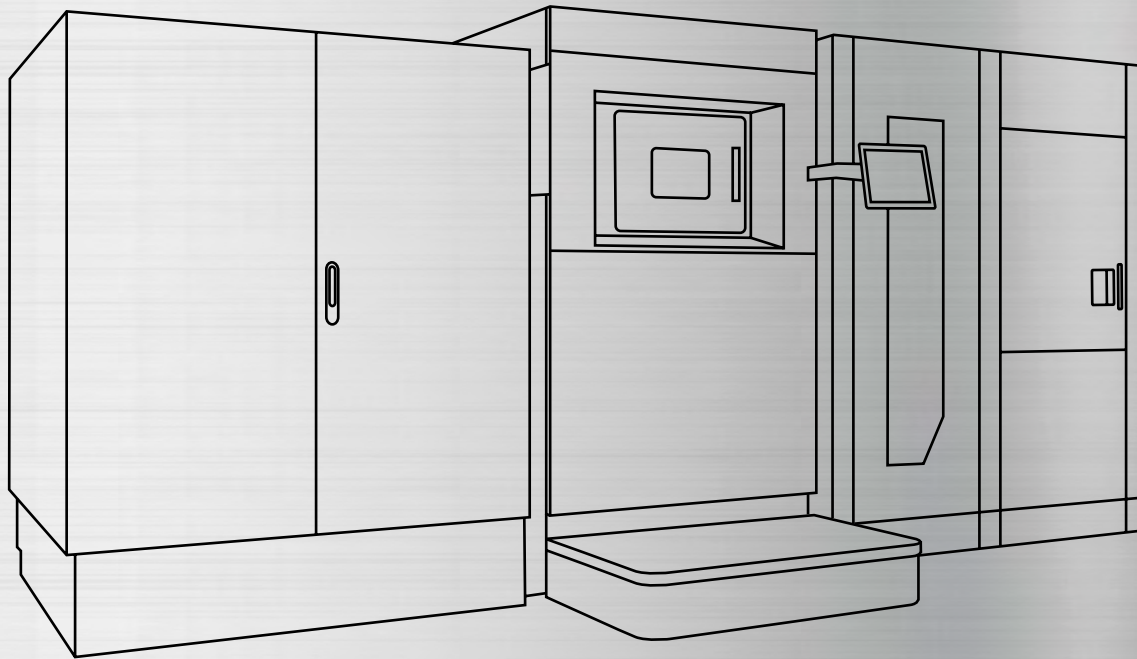


Mechanical properties ISO6892-1

Heat treated	Yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation at break A [%]
Vertical	1990	2070	3.5
Horizontal	2000	2070	4



T90: Tolerance intervals provide lower bounds where 90 % of the population falls with 95 % confidence.
Tolerance intervals are based on validation data / QA statistics and are not directly transferable to other systems.



EOS MaragingSteel MS1 for EOS M 400-4 | 80 μm

Process Information

Chemical and Physical Part Properties

Mechanical Properties

Additional Data

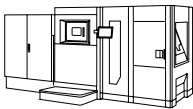
EOS MaragingSteel MS1 for EOS M 400-4 | 80 µm
Process Information

This process product is optimized for fast production of MS1 parts with EOS M 400-4.

System set-up		EOS M 400-4	
EOSPAR name		MS1_080_CoreM404	
Software requirements		EOSPRINT 2.16 or newer EOSYSTEM 2.20 or newer	
Powder part no.		9011-0016 9030-0024	
Recoater blade		Ceramic blade	
Nozzle		Aerospike	
Inert gas		Nitrogen	
Sieve		63 µm	

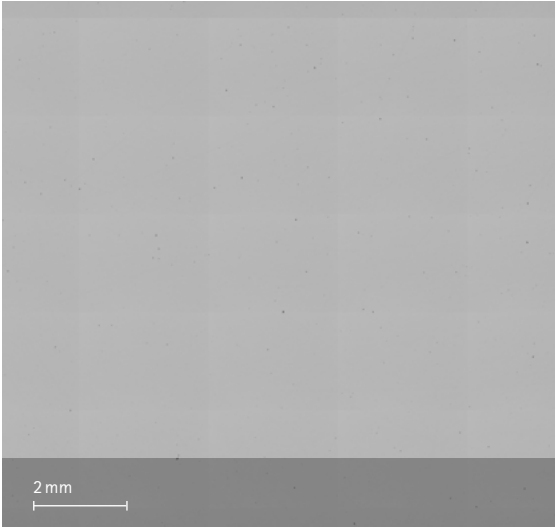
Additional information	
Layer thickness	80 µm
Volume rate	up to 4 x 7.68 mm ³ /s

Chemical and Physical Properties of Parts¹



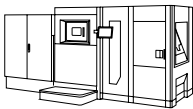
Chemical composition of built parts is compliant to EOS MaragingSteel MS1 powder chemical composition.

Micrograph of polished surface



Defects	Result
Average defect percentage	< 0.1 %

Mechanical Properties¹

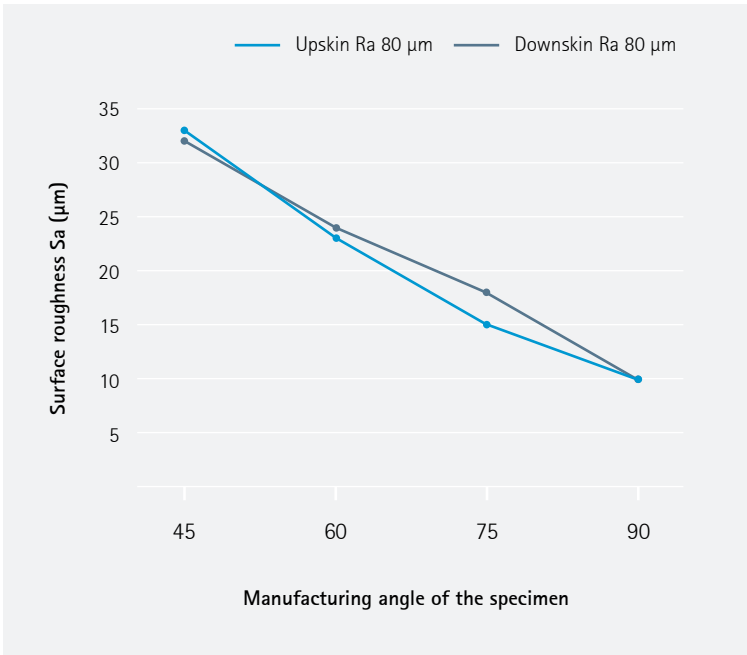


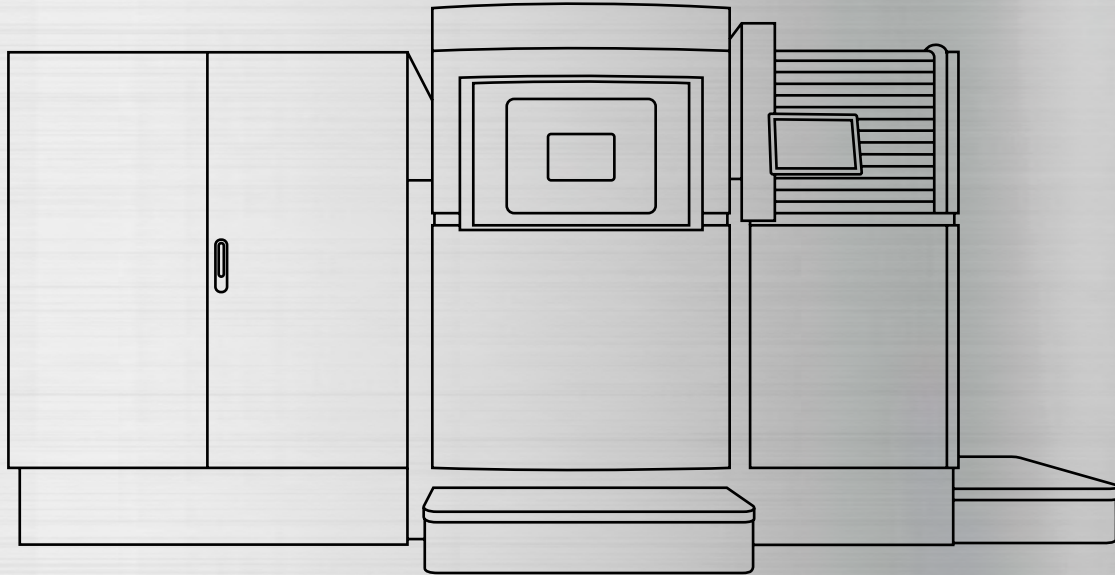
Typical properties ISO6892-1

Heat treated	Yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation at break A [%]
Vertical	1980	2050	4
Horizontal	1990	2055	4

Additional Data¹

Surface Roughness





EOS MaragingSteel MS1 for EOS M 400 | 50 µm

Process Information

Chemical and Physical Part Properties

Mechanical Properties

Additional Data

EOS MaragingSteel MS1 for EOS M 400 | 50 µm

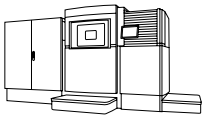
Process Information

This process product is optimized for fast production of MS1 parts with EOS M 400-1.

System set-up	EOS M 400-1
EOSPAR name	MS1_050_FlexM400
Powder part no.	9011-0016 9030-0024
Recoater blade	Ceramic blade
Inert gas	Nitrogen
Sieve	63 µm

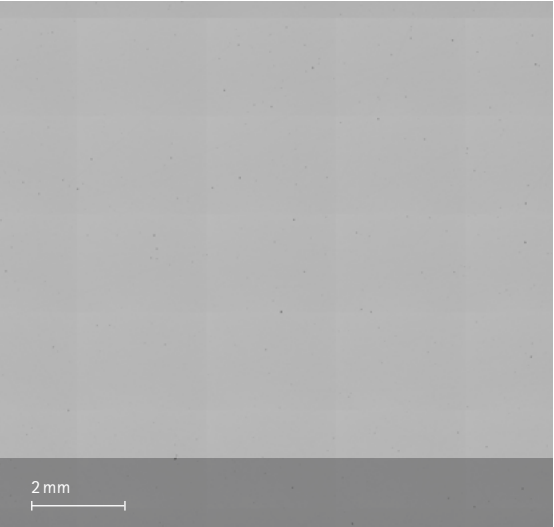
Additional information	
Layer thickness	50 µm
Typical dimensional change after HT	+0.1 %
Volume rate	5.5 mm³/s

Chemical and Physical Properties of Parts¹



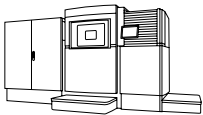
Chemical composition of built parts is compliant to EOS MaragingSteel MS1 powder chemical composition.

Micrograph of polished surface



Defects	Result
Average defect percentage	< 0.1 %

Mechanical Properties¹



Typical properties ISO6892-1

Heat treated	Yield strength R _{p0.2} [MPa]	Tensile strength R _m [MPa]	Elongation at break A [%]
Vertical	2 000	2 100	2
Horizontal	2 030	2 100	2

Additional Data¹

Surface Roughness

Vertical	Ra 9 µm
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Headquarters

EOS GmbH
Electro Optical Systems
Robert-Stirling-Ring 1
D-82152 Krailling/Munich
Germany
Phone +49 89 893 36-0
info@eos.info

www.eos.info

in EOS

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Further Offices

EOS France
Phone +33 437 497 676

EOS Greater China
Phone +86 21 602 307 00

EOS India
Phone +91 443 964 8000

EOS Italy
Phone +39 023 340 1659

EOS Japan
Phone +81 45 670 0250

EOS Korea
Phone +82 2 6330 5800

EOS Nordic & Baltic
Phone +46 31 760 4640

EOS of North America
Phone +1 877 388 7916

EOS Singapore
Phone +65 6430 0463

EOS UK
Phone +44 1926 675 110

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Status 03/2025

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Cover: This image shows a possible application.

