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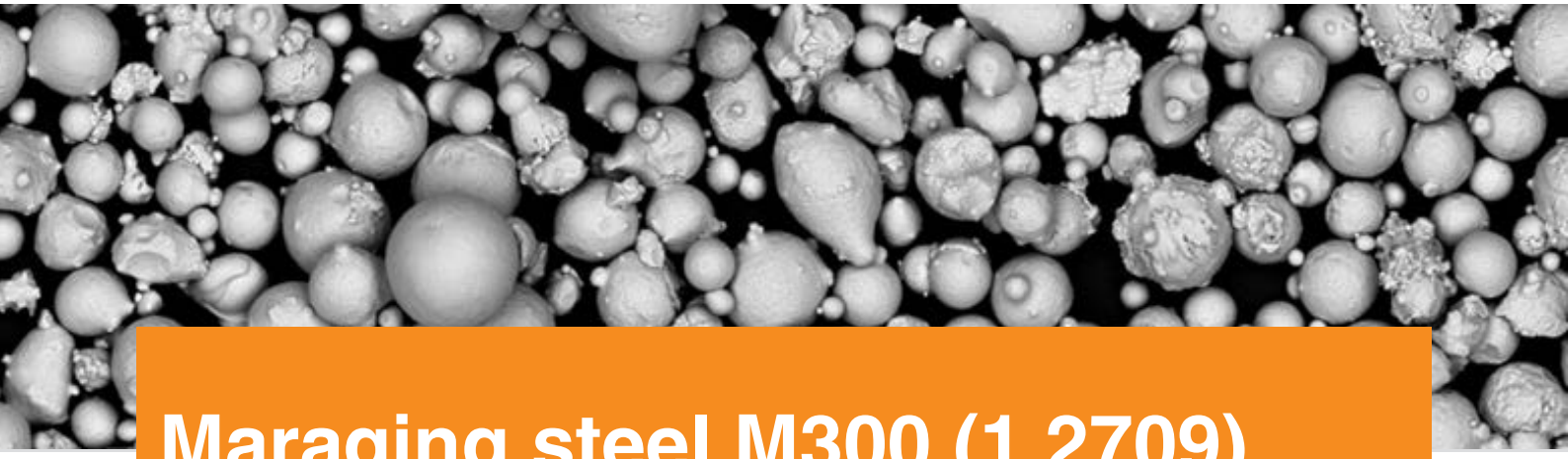

Maraging steel M300 (1.2709)

Parameter set options

Layer thickness	Optimised for	Laser mode	Page
50 µm	Single laser per part	Modulated	4
60 µm	Single laser per part	Continuous wave	5

To download the latest material files, visit **www.renishaw.com/softwarelicensing.**

Material description

Maraging steel M300 (DIN/W.Nr 1.2709) is an iron alloy with a martensitic crystal structure and is strengthened via aging at approximately 500 °C (900 °F), hence the name 'maraging'. This ultra-low carbon alloy has 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.

Material properties

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

Applications

- Tooling inserts
- Moulds and dies
- High strength components

Disclaimer

The mechanical property data featured in this document were obtained from tests performed in Renishaw's laboratories and they indicate the mechanical properties that can be achieved. The data is not intended as a guaranteed minimum specification.

Glossary of terms

Term	Definition
Scan strategy	Determines the path the laser will take to melt the cross-sectional area of the parts featured in each layer of the build process.
Meander	A scan strategy that takes the form of a straight-line vector path that bounces back and forth from each side of the part border. Meander strategy is quick and ideal for parts with a small XY cross section.
Stripe	A scan strategy where the area within the part border is split into strips and a meander technique is used within each strip. Stripe is ideal for parts with a large XY cross section.

Typical wrought material properties

Material property	Wrought material value
Density	8.1 g/cm^3
Thermal conductivity	14 W/mK at 20 °C, 21 W/mK at 600 °C, 29 W/mK at 1 300 °C
Melting temperature	1 413 °C
Coefficient of thermal expansion	10×10^{-6} K^{-1}

Recommended composition of powder

Element	Mass (%)
Iron	Balance
Nickel	17.00 to 19.00
Cobalt	8.00 to 10.00
Molybdenum	4.50 to 5.20
Titanium	0.60 to 0.80
Chromium	≤ 0.50
Aluminium	≤ 0.15
Manganese	≤ 0.10
Silicon	≤ 0.10
Niobium	≤ 0.05
Tanatalum	≤ 0.05
Vanadium	≤ 0.05
Tungsten	≤ 0.05
Carbon	≤ 0.03
Oxygen	≤ 0.03
Nitrogen	≤ 0.02
Boron	≤ 0.01
Phosporus	≤ 0.01
Sulfur	≤ 0.01
Residual elements	≤ 0.10 total

Recommended powder size distribution: 15 µm to 45 µm.

The values shown in this table are for 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. To purchase powder from Renishaw, visit the online store at **www.renishaw.com/shop**.

Please contact Renishaw for further information about specifications or if you require support in qualifying non-Renishaw powders.

Parameter set summary

Layer thickness	Optimised for	Laser mode	Gas flow rate	Build rate	
50 µm	Single laser per part	Modulated	190 m^3/h	One laser: 13.5 cm^3/h	Four lasers: 54 cm^3/h

Material files: MarStM300_500QS_A50_M_01_B (meander scan strategy)
MarStM300_500QS_A50_S_01_B (stripe scan strategy)

Properties of additively manufactured components

NOTE: This parameter set is optimised for bulk density. The material properties in this table are indicative only. Further modification of the material file may be required to suit your application.

		As built	Age hardened [1]
Bulk density [2]		≥ 99.9%	–
Ultimate tensile strength [3]	Vertical (Z)	979 MPa ±7 MPa	1 916 MPa ±16 MPa
Yield strength [3]	Vertical (Z)	822 MPa ±7 MPa	1 854 MPa ±16 MPa
Elongation after fracture [3]	Vertical (Z)	14% ±1%	8% ±1%
Modulus of elasticity [3]	Vertical (Z)	140 GPa ±8 GPa	171 GPa ±6 GPa

Mechanical test samples were created using four lasers, one laser per sample and with no downstream processing. Meander scan strategy was used for vertical samples.

1 Age hardening method used for testing: Under argon at 15 L/min flow rate, heat at 5 °C/min to 490 °C ±10 °C, then hold temperature for 6 hours. Air cool to room temperature.

2 Measured optically on 10 mm × 10 mm × 10 mm samples at 75× magnification.

3 Tested at ambient temperature to ASTM E8. Machined prior to testing. Values based on 16 samples.

Parameter set summary

Layer thickness	Optimised for	Laser mode	Gas flow rate	Build rate	
60 µm	Single laser per part	Modulated	190 m^3/h	One laser: 21.6 cm^3/h	Four lasers: 86.4 cm^3/h

Material files: MarStM300_500QS_B60_M_01_A (meander scan strategy)
MarStM300_500QS_B60_S_01_A (stripe scan strategy)

Properties of additively manufactured components

NOTE: This parameter set is optimised for bulk density. The material properties in this table are indicative only. Further modification of the material file may be required to suit your application.

		As built	Age hardened [1]
Bulk density [2]		≥ 99.8%	≥ 99.8%
Ultimate tensile strength [3]	Horizontal (XY)	1 146 MPa ±21 MPa	2 029 MPa ±12 MPa
	Vertical (Z) – Meander	1 044 MPa ±9 MPa	1 942 MPa ±16 MPa
	Vertical (Z) – Stripe	1 056 MPa ±7 MPa	1 974 MPa ±12 MPa
Yield strength [3]	Horizontal (XY)	972 MPa ±20 MPa	1 969 MPa ±13 MPa
	Vertical (Z) – Meander	882 MPa ±11 MPa	1 870 MPa ±23 MPa
	Vertical (Z) – Stripe	902 MPa ±8 MPa	1 911 MPa ±15 MPa
Elongation after fracture [3]	Horizontal (XY)	13% ±1%	6% ±1%
	Vertical (Z) – Meander	16% ±1%	6% ±1%
	Vertical (Z) – Stripe	15% ±1%	5% ±1%
Modulus of elasticity [3]	Horizontal (XY)	191 MPa ±21 MPa	192 MPa ±12 MPa
	Vertical (Z) – Meander	161 MPa ±12 MPa	168 MPa ±6 MPa
	Vertical (Z) – Stripe	169 MPa ±11 MPa	185 MPa ±6 MPa
Hardness (Vickers) [4]	Horizontal (XY)	330 HV0.5 ±9 HV0.5	587 MPa ±11 MPa
	Vertical (Z)	333 HV0.5 ±14 HV0.5	562 MPa ±12 MPa
Surface roughness [5]	Vertical (Z) (Median Ra)	5 µm ±1 µm	–
	Vertical (Z) (Median Rz)	43 µm ±4 µm	–
Plastometrex Yield strength [6]	Horizontal (XY)	781 MPa ±27 MPa	1 871 MPa ±71 MPa
Plastometrex Ultimate Tensile Strength [6]	Horizontal (XY)	1 096 MPa ±43 MPa	1 982 MPa ±30 MPa

Mechanical test samples were created using four lasers, one laser per sample and with no downstream processing. The scan strategy used for vertical samples is indicated in the table above. Stripe scan strategy was used for horizontal samples.

1 Age hardening method used for testing: Under argon at 15 L/min flow rate, heat at 5 °C/min to 490 °C ±10 °C, then hold temperature for 6 hours. Air cool to room temperature.

2 Measured optically on a 10 mm × 10 mm × 10 mm sample at 75× magnification.

3 Tested at ambient temperature to ASTM E8. Machined prior to testing. Values based on 16 samples.

4 Tested to ASTM E384-11 after polishing.

5 Tested on as-built vertical surfaces using laser interferometry. Tested to JIS B 0601 2001 (ISO 4287:1997).

6 Plastometrex's standard indentation procedure was used to generate the data. Indents were carried out on 10 mm × 10 mm × 10 mm samples. Values are based on 6 indents from 3 samples.

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